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ABSTRACT

Twenty papers originally presented at a conference organized by London University on "Efficiency in Teaching Methods in Higher Education" are presented. After an introduction by David Warren Piper, the following papers are included: "Old Prejudices and New Management Tools" (Gerald Fowler); "Efficiency in Higher Education" (Leslie Wagner); "What Makes Teaching Effective" (Piper); "Towards Greater Efficiency in Teaching and Learning in Higher Education" (Marcel L. Goldschmid); "On Defining Quality of Education" (Hans F. M. Crombag); "Effectiveness of Learning: The Place of Study" (Roderick McKay); "Microteaching versus Lectures: A Case Study in Cost-Effectiveness" (Mantz Yorke); "The Computer in Practice as an Aid to the Efficiency and Assessment of Learning" (F. T. C. Harris); "Computer Assisted Learning: An Efficient Technique or an Extravagant Diversion?" (J. R. Hartley); "The Keller Plan: Cost and Benefits of Self-paced Self-Study" (Peter J. Unsworth); "An Evaluation of an Application of a Self-learning Strategy at the Stockholm School of Economics, 1975" (Monica Lindstedt and Harold Berg); "Flexibility with Control: An Example of a Classroom Contract and Some Other Attempts to Increase Effectiveness" (Piper); "Problem Solvers, Publishers or Pressure Groups? Some Comments on Interinstitutional Collaboration in Higher Education" (Eric Hewton); "The Higher Education Learning Project" (Paul Black); "Educational Policy in Denmark and Its Effects on Course Planning and Teaching Methods in Higher Education" (Joan Conrad); "Efficient Teaching: A View from the Higher Education System" (Tyrell Burgess); "The Efficiency and Effectiveness of Knowledge" (D. W. S. Gray); "Effective Efficiency" (Piper); and "The Debate over Teaching Efficiency and Effectiveness: Challenges and Conflicts" (W. L. Weinstein). (PHR)

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THE EFFICIENCY AND EFFECTIVENESS OF TEACHING IN HIGHER EDUCATION

David Warren Piper (ed)

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Contents

Introduction 7
David Warren Piper

Old Prejudices and New Management Tools 13
Gerald Fowler

Efficiency in Higher Education 25
Leslie Wagner

What Makes Teaching Effective 39
David Warren Piper

Towards Greater Efficiency in Teaching and Learning in Higher Education 53
Marcel L Goldschmid

On Defining Quality of Education 68
Hans F M Crombag

Effectiveness of Learning: The Place of Study 86
Roderick McKay

Microteaching versus Lectures: A Case Study in Cost-effectiveness 95
Mantz Yorke

The Computer in Practice as an Aid to the Efficiency and Assessment of Learning 107
F T C Harris

Computer Assisted Learning: An Efficient Technique or An Extravagant Diversion? 119
J R Hartley

The Keller Plan: Cost and Benefits of Self-paced Self-study 135
P J Unsworth

An Evaluation of an Application of a Self-learning Strategy at the Stockholm School of Economics, 1975 147
Monica Lindstedt and Harald Berg

Flexibility with Control: An Example of a Classroom Contract and Some Other Attempts to Increase Effectiveness 171
David Warren Piper

Problem Solvers, Publishers or Pressure Groups? Some Comments on Inter-institutional Collaboration in Higher Education 183
Eric Hewton

The Higher Education Learning Project (Physics) 200
Paul Black

Educational Policy in Denmark and its Effects on Course Planning and Teaching Methods in Higher Education 210
Joan Conrad

Efficient Teaching: A View from the Higher Education System 221
Tyrrell Burgess

The Efficiency and Effectiveness of Knowledge 224
D W S Gray

Effective Efficiency 236
David Warren Piper

The Debate over Teaching Efficiency and Effectiveness: Challenges and Conflicts 244
W L Weinstein

Introduction

The papers in this book originated from a conference organised by the London University Teaching Methods Unit in 1976. It came at a time when we had been told that the education budget would be squeezed until the pips squeaked. The conference was entitled 'Efficiency in Teaching Methods in Higher Education'. It is not an inspired title but one over which we struggled. We were feeling our way to a succinct expression of what we wanted the conference to be about. We were clear in our minds what we did *not* want it to be about. We did not want a conference on 'The Economics of Education' because that is a subject which has already established as its central concern the efficiency of total educational systems, in which 'efficiency' relates to the *per capita* cost of students. We wanted to concentrate on teaching. However, we did not want to limit discussion to the effectiveness of teaching methods, in the sense of how well students learned from them, without taking costs into account. We were trying to lodge our conference in the ground between the economists and the psychologists. We wanted to explore how the quality of education could be improved through efficient teaching. We were seeking improvements which could be effected within existing budgets. We were anxious to avoid seeming to show how education could be done on the cheap, disguising unmeasurable losses in quality with simplistic sleight of accountancy. We hoped for a constructive response to the pressures of the economic crisis from within the higher education system. We believe we got it.

The economists' and the psychologists' views of education had to be our starting point. Then we

wanted to include a government and an educationalist's interpretation of educational efficiency. The meat of the conference was to be the reported experience of practitioners trying to evolve more efficient ways of teaching. Of course, there would also be room for comment. So it was that we envisaged the conference rather like a meat pie. It had a base upon which all else could sit, sides by which it related to the outside world, a meaty filling with a touch of spice and seasoning, and a decorative top to give it unity.

The base was to be four papers. We asked Leslie Wagner to set out for us an economist's view of efficiency in education. We invited Marcel Goldschmid to give an overview of an educational psychologist's approach to efficiency in teaching. We volunteered a contribution on effectiveness of teaching from our Unit. As both effectiveness and efficiency imply some notion of quality we needed a paper exploring that idea. We were offered one by Hans Crombag. We next turned our attention to the pie's sides: we wanted to put the subject in the context of the education system. We invited the then Minister of State for Higher Education to give a view from the vantage point of central government. We were fortunate that the date of the conference coincided with one of Gerry Fowler's short periods in office. To give a view from inside the system we asked Tyrrell Burgess to speak as an habitual commentator on the education system and a successful practitioner within it. We should perhaps have sought a student view and our design may be the weaker for its absence.

The meaty filling was to be a rich mixture: we knew some of the ingredients that we wanted, others we came upon in our search. The subject matter of the papers we attracted ranged from the particular (a method for setting and marking examinations) to the grand-scale (an examination of a change in national educational policy). All the papers set out to comment on the effect a particular innovation had on the efficiency of teaching. Some comment on the effect an innovation had on the nature, as well as on the quantity, of what students learned.

Roderick McKay gives an example of the 'base-line data' an institution can collect about the work habits of its students. This is the kind of background information needed to interpret studies on the efficiency of teaching. Mantz York provides an

illustration of a teacher undertaking a comparative study of two teaching methods within the daily life of a large institution. We invited two people to discuss the effectiveness of using computers. Mr F T C Harris details various services available in London for marking questionnaires by computer. Such procedures can be used for the statistical analysis of survey returns, and (more importantly in the context of this volume) for the marking of examination questions and for students to test themselves as an aid to learning. There is a rich literature on multiple choice questionnaires and on programmed learning which details their uses and limitations. Mr Harris accordingly confines himself to reporting the charges made for various services. They do not, of course, represent the full cost.

The second of the articles on computers may be regarded as being the first of three papers which illustrate three strategies of learning currently exciting attention in the educational world. They are: computer assisted learning; personalised systems of instruction; and self-learning. Perhaps computer assisted learning, of the three, is most concerned with increasing the speed with which students assimilate information. Self-learning on the other hand perhaps most changes the nature of what is learned when compared with a traditional mode of teaching. Mr J Hartley reviews types of computer based learning and reports on a co-operative venture between Leeds Polytechnic and the Universities of Leeds and Bradford to teach statistics by computer. The scheme involves one thousand students and the aim of the project is to produce a teaching programme which can be used by a variety of departments whose students learn statistics as an adjunct to their main subject. Those of us who have been traumatised by service teaching will be relieved to read of the success of the project.

The Keller Plan was the original personalised system of instruction. Peter Unsworth reviews the success of some attempts to introduce the Keller plan in this country. Monica Lindstedt and Harald Berg give a personal account of their involvement in a self-learning scheme in which students initiated part of their own work-programmes and assessed their own progress. We have not assembled a review of various attempts at self-learning schemes although several have been tried. However Lindstedt and Berg's

account gives a good insight into how this approach radically changes the students' experience of education and what they learn from it.

Peer-teaching, where students teach each other, is another strategy which offers hope for improving students' learning without an added investment in staff salaries. There is no single paper devoted to the topic in this volume, but peer-teaching does feature as part of the Keller plan and in self-learning schemes. Other references may be found in Goldschmid's paper. Tyrrell Burgess makes passing reference to the School of Independent Studies at the North-East London Polytechnic, one of whose features is that each student draws up a proposal for his individual work and this forms the basis of a contract between student and polytechnic.

The student is examined according to the contract, and can point to any shortcomings from the institution in mitigation of poor performance. The idea of a learning/teaching contract is another innovation attracting attention which was under-represented at the conference. By way of filling what was a gap at the original conference I have added an outline description of a plan put into effect at the Architectural Association School of Architecture which illustrates a course of study based on a contract. None of these six innovations is perhaps as radical as project oriented courses in which traditional subjects are abandoned.

There are then five innovations in teaching strategies represented in these papers: computer assisted learning; personalised systems of instruction; self-learning; learning/teaching contracts; peer-teaching. None of them is exclusive of the other four and many of the innovative courses combine several of them. Each requires money to be spent in ways which differ from the usual. Perhaps it is this aspect of innovation that most precipitates questions about their efficiency. A sixth, the deliberate teaching of study skills, is mentioned although is perhaps not to be regarded by itself as a strategy. Classes on study skills can be arranged without requiring money to be spent in an unusual way and for that reason may more easily be introduced. Readers interested in project-orientated courses can find examples in Cornwall, Schmithals and Jaques 'Project Orientation in Higher Education , 1977. Each of

these innovations, it is claimed, adds to the effectiveness of education.

In recent years the Nuffield Foundation has supported a number of co-operative schemes in which teaching staff from different teaching institutions work together on educational problems. This represents another approach to increasing educational efficiency. Not only does the approach allow for economies of scale but it offers the opportunity of specialist teachers jointly producing teaching materials of a quality any individual would be unlikely to reach working alone. Eric Hewton gives an overview of the Nuffield projects and Paul Black describes one of the projects from the inside.

The remaining paper is a particularly succulent morsel, reminding us that teaching effectiveness relies on more than the teacher and the student. Joan Conrad traces the effect on teaching and learning of a national policy aimed at increasing the efficiency of an education system.

With the pie-case now filled with that meaty mixture we turned our attention to the pie-crust. We invited David Gray and Bill Weinstein to attend the conference and comment on the contributions. Their papers, like good pie-crusts, are not only decorative but functional. Apart from myself, they are the only two contributors to this volume who had the opportunity of reading what others had written before committing themselves to paper. They complete the pie, giving shape to the whole.

Dishes do not always turn out as the cook intended. As I indicated above I have already cheated by adding one more ingredient to the filling before offering it to the general reader. There were other little surprises. Hans Crombag's contribution is perhaps rather more spice than a plain base upon which to build a conference pie. Some will find his notions of 'quality of graduates' and 'efficiency of education' controversial. Tyrrell Burgess too did not quite fit in with our original conception, but did something rather better. His paper falls in more easily with the critical papers of Gray and Weinstein. That final group of critical essays has been augmented by one of my own. It started its life as the opening paragraph to UTMU's contribution on 'Effectiveness of Teaching'. It progressed from there to the closing paragraphs of this introduction.

My colleagues pointed out that it was difficult to follow, indeed impossible, without foreknowledge of the other papers in this volume. I have therefore slipped it into the final section of the book and crave the indulgence of the reader in having produced now two papers above my quota.

It is not easy in a few sentences to summarise the critical essays, for they touch on many of the specific issues raised in the conference papers. Significantly, however, all four, although written independently, have two major themes in common. They each examine the language used to debate education. Not surprisingly the words 'efficiency' and 'effectiveness' are accorded especial attention. Secondly they each highlight the political responsibility of educators in the definition and achievement of quality in high education. Here is the one issue on which to be an academic implies a responsibility to be more than academic.

The reader will find the order of the papers much as it has been described above, but with some significant changes. Gerald Fowler's paper has been put first as it was delivered by way of an opening address. As explained above Tyrrell Burgess's paper, which actually brought the conference to a felicitous close, has been put among the commentaries. So if the conference was conceived like a pie, this volume is more like a sandwich. It has its base papers, its reports on innovations, and its commenting essays.

Old Prejudices and New Management Tools

Gerald Fowler

I am glad that your title for this Conference refers to higher education in general. While your Unit is called "the *University* Teaching Methods Unit", I am sure you will recognise that the problems of how one achieves better, more efficient, and more effective teaching extend beyond the universities to the whole of higher education, and indeed beyond that throughout the post-compulsory sector of education. The problems of the 16-19 age range may not be the same, but they certainly overlap those found in higher education. The problems with wider adult education, especially in a continuing or recurrent education system, will again be different in scale and to some degree in kind, but it is imperative that we are constantly aware of the possible applicability of some of the work done in specifically higher education to other areas of post-compulsory provision, and vice versa. Indeed, it seems to me that one of the major difficulties that we face in trying to achieve greater cost effectiveness in post-compulsory education is precisely that of the dissemination and absorption of information. New and more effective methods developed in one institution lose much of their point unless those working in other institutions, and indeed in extra-institutional contexts, know of them and can study their application to their own problems. Your initiative in organising this conference is therefore welcome, but I hope that it will be just one mark of a greater effort throughout post-compulsory education to exchange and utilise new information and research findings about teaching methods.

The difficulties we face are formidable. On the one hand, many people working in higher education are wedded to teaching methods, (sometimes perhaps with justification, though the justification is rarely

offered)which not only rely heavily on what is now a very expensive commodity, namely highly qualified manpower, but do not necessarily make the most effective use of that manpower. Here, of course, the world has changed in the past decade greatly to the disadvantage of those who wish to continue with traditional instructional methods. This is simply because the price of many types of manpower has increased more than the cost of materials or some types of equipment. Thus, to take a simple example, the relative price of the cassette tape recorder has come down sharply. At the same time, the salaries, not only of specifically teaching staff, but also of ancillary staff, have risen considerably in real terms. There may be those in the universities, looking only to the events of last year, who will cavil at that proposition. If they look over a wider time scale, and look not only to their own sector but to other sectors of higher education, they will find it hard to disagree with it. In this context it is more important than ever to examine the value of, for example, the traditional lecture as an effective use of highly qualified manpower. It may well be that it is exactly that, when the lecture audience is very large, and the lecturer is communicating new material, unpublished, and not recorded in a non-print form either. Where neither of those conditions apply, it may in fact be a very wasteful use of manpower. To avoid misunderstanding, I should point out that I am not arguing here for a reduction in staffing standards as desirable in itself; I am merely suggesting that it is imperative that we make the most cost-effective use of expensive manpower.

On the other hand, we have also inherited certain organisational systems which positively encourage the use of traditional methods of teaching, irrespective of their merits. There are posts in universities where the holder is required to deliver a given number of lectures in a term or an academic year, irrespective of whether this is the most valuable use of his time, and irrespective of whether he has anything new to say. One might in passing point to the equal and opposite fallacy, namely that the excellent teacher should often be required by the terms of his contract to undertake original research, and by the promotion system to publish that research, irrespective of whether he would be better engaged for a larger proportion of his time in teaching, and irrespective of whether

the research he undertakes is likely to be of any substantial or lasting value. There is a whole complex of thorny problems surrounding that seemingly simple sounding proposition, and of course I do not want to involve myself in them today, but we should recognise their existence. In the non-university sector, the principle of contact hours lies at the heart of some of the salary arrangements. This of course discourages innovation whereby direct contact hours between learner and teacher may be reduced. At the same time, there is a long-standing tradition that arrangements shall reflect the requirement that the more junior the member of staff, the greater shall be the proportion of his working week that he devotes to teaching. This may mean that the senior, experienced and perhaps excellent teacher is actually required to teach considerably less than the young man who is just learning his trade, may have less to offer, and many simultaneously be seeking to work with enthusiasm and energy in a new and valuable field of research. Today I wish to do no more than note these problems; I am, however, convinced that we must find a solution to them.

There are some yet more deep-seated difficulties about our traditional ways of looking at higher education which I should also mention, so that at least we have them in the back of our minds during this conference. One is of course the doctrine that institutions of higher education should in general all undertake teaching and research which covers at least a wide section of the academic spectrum. No one of course now adopts the extreme form of that proposition, that each institution should cover every discipline and sub-discipline. Human knowledge has expanded too rapidly for that any longer to be tenable. The more moderate form of the doctrine does however result in the existence of some very small departments, which find it difficult to attract the number of students which would be necessary to make their course provision viable, or cost-effective when viewed against the norms obtaining in the same discipline elsewhere.

Then there is of course the doctrine of institutional autonomy, by which I do not of course mean the autonomy of institutions of higher education from the State. Few in this country will quarrel with that. I refer rather to the autonomy of each institution of higher education in its relationship

with all other institutions of higher education. In order to make the best use of resources in a particular discipline, it is often desirable that there should be collaboration in the use of those resources, whether they be human or material. Such collaborative schemes do now exist in the university sector and elsewhere, and I look with hope to a greater development of them.

On the same conceptual plane is the doctrine of the autonomy of the teacher. By that I do not mean what is conventionally meant by academic freedom. I mean rather the deep-seated belief that the professional self-respect, indeed almost the virility of the teacher, can only be safeguarded if he uses teaching materials prepared by himself, alone or primarily, and not by others, and sometimes if those materials have been prepared individually rather than collaboratively. I hope that the success of the Open University will lead us more generally to quesiton that doctrine. There, highly succe- ful teaching materials have been prepared collaboratively on the course design team basis; almost no material that issues from the University can be said to be the work of one man alone; and most of the teaching, in a face-to-face context, is done by others than those who have prepared the teaching material. That system has, I am sure, a wider application, and could lead to some substantial savings. By contrast, it remains the case in many institutions of higher education, not least in the public sector, that even where basic first year work in several disciplines heavily overlaps, each department shall prepare and conduct its own teaching separately from the provision made in other departments. Can there be a rational justification of this practice?

Mention of the Open University leads me to allude to one or two requirements imposed on us by its very existence. In the first place, other institutions now make increasing use of Open University material. That is splendid. On the other hand, we should always remember that where another institution uses Open University material in a course that leads to a terminal qualification at lower than degree level, then the student may subsequently be eligible to convert his qualification into a degree at the Open University, receiving due credit exemption for what he has already accomplished. It would be a serious matter indeed if random and uncoordinated use of OU material permitted some students to study the

same material twice, gaining double credit for it, on the route to a degree. That would scarcely count as efficiency in higher education teaching.

Secondly, as I have suggested, other institutions of higher education might learn a great deal from Open University course design and production methods. That learning process would be greatly facilitated if arrangements could be made bilaterally between the Open University and other institutions for some interchange of staff. That is a matter for the institutions concerned, but I mention it lest not all may be aware of the advantages that could accrue to them from such arrangements.

Thirdly, the Open University, with its credit system, and the growth of modular courses, whether full-time or part-time, in other institutions of higher education (not least in the public sector), together pose a new problem of ensuring that modular or unit-based course schemes are compatible over as many institutions as possible. I stress the word "compatible" and hasten to add that by that I do not mean that they must all be exactly the same. There are two reasons for saying this. In order to minimise drop-out among part-time students, and thus enhance cost effectiveness in the use of resources, it is imperative that their transfer from one institution to another should be facilitated. On the other, it is possible to envisage transfer between institutions of even full-time students, although they may not be many, in order to open to them specialist teaching in a particular sub-discipline which can be offered economically in no more than a few centres. Clearly this is very much easier where the basic structure of course schemes is compatible, and again it can lead to greater flexibility in the higher education system as a whole, without any financial penalty - that is to say, to greater efficiency in the use of the totality of resources available to us.

I turn now to the contribution that educational technology may make to enhancing the efficiency of teaching in higher education. This is a natural enough transition, granted the achievements of the Open University. In general however we are not, of course, looking to the use of the national broadcasting network. A wide range of equipment, which may be used whether in institutional or extra-institutional settings, is now available - audio-visual equipment recording and reproduction equip-

ment and computing equipment. So far however such equipment is being used mainly to enrich teaching, that is to say as audio-visual or computing *aids*. It has therefore inevitably raised costs rather than reducing them. That is not to say that its use has always been non-cost-effective, but it has certainly not achieved a higher through-put of students at the same or lower cost. Teaching in higher education is still mainly in the traditional pattern of lectures, classes and tutorials. There is no doubt at all that there is room here for an exploration of potential for cost reduction through less labour-intensive, though no less effective, teaching. Thus, the DES funded computer education programme, which covers a series of investigations of computer uses in education, provides for the technical, financial and educational evaluation of those uses.

Similarly, Professor Elton's investigation at Surrey University of the potential of programmed learning, examining the use of programmed learning texts and the reduction of lectures in science teaching, aims to increase student involvement and to match the pace of learning to student ability. The scheme makes provision for frequent progress checks by short-answer tests, and should result in improved feedback to teaching staff. Again, the Department is sponsoring work under Professor Lumsden at Heriot-Watt University in the development of course material suitable for use in the teaching of basic economics, whether in first year under-graduate courses, or in the economics component of commercial courses, or possibly even in sixth forms. The familiar reduction of lecture input is combined with the use of programmed learning texts, case studies and computer simulation games. Standardised tests once more provide a regular check on progress. There seems good reason to hope that such developments will ultimately give us better results without increase in real cost. I am sure, however, so complex is this field, that we are right to make haste slowly, and to evaluate such projects as they proceed, before seeking to generalise their applicability.

A second hopeful approach lies less within the province of the educational technologist than that of the educational manager, economist, and accountant. Most of the work done in this country under the umbrella of the Institutional Management In Higher Education programme of the OECD Centre for

Educational Research and Innovation, falls under this rubric. About a fifth of the 75 institutions from 18 countries which are participating in this programme are from the United Kingdom, 7 of them being universities and 8 polytechnics. The programme embraces the promotion of research, training, and the dissemination of information. Each of the member institutions makes an annual contribution of the order of £750. While there is no government financial contribution to the programme as a whole, the Department at an early stage agreed to sponsor a few research projects under the auspices of the programme. Even here we provide only part of the total cost, and this programme is in essence a good example of co-operative and organised self-help by institutions of higher education.

The first phase of this programme, now completed, included two participating institutions within the United Kingdom. Professor Bottomley's work at Bradford will be familiar to most of you. A study of the costs and potential economies in higher education showed that substantial savings in staff costs per student were possible from filling up under-subscribed courses. One might say that this was a glimpse of the obvious, but it is always valuable to have the obvious demonstrated to the non-believer, and there are many within that category in higher education. Staff savings can also result from curbing the number of course options, and, needless to say, from reducing the proportion of staff time given to research. (Once more I shall do no more than allude to that problem.) The more intensive use of building and of technician staff may also give savings. Above all, the lesson of Bottomley's study is that in the context of expanding our higher education system, or in expanding individual institutions, we can plan to realise lower unit costs. It may be that his work was done a little late in the day, when, as we can now see with the benefit of hindsight, the most dramatic expansion in higher education was already nearing its end. If however we again enter a period of rapid expansion, then I hope we shall not fail to learn the lessons that Bottomley has taught us, and that in the meantime institutions individually may make more limited but profitable use of his research findings.

If I may pursue for a second the Bradford theme, Dunworth's work there suggested that constant staff/

student ratio formulae give no incentive to greater efficiency. Dunworth argued that the existing system of resource allocation to university departments encouraged an over-statement by them of their needs. He concluded that we could improve efficiency through decentralised decision making, based upon fixed budgetary allocations to each department, with a freedom to apply savings to other departmental priorities. Now clearly that is a matter for the universities themselves. I hope however, that Dunworth's recommendations will not be scorned in internal university budgetary allocations.

A second IMHE project was that of Professor Simpson at Lancaster. Investigating staff requirements for new and expanded courses, Simpson showed how much this was influenced by the mix between lectures, classes and tutorials. This ties in very closely with work done for the local authority pooling committee by John Delaney of my Department, with regard to public sector institutions of higher education. Delaney concentrated on teaching staff time as the largest single element in institutional costs, and unsurprisingly discovered wide disparities in staffing ratios. What he recommended was the introduction of staffing norms, based on standard good practice, with due allowance made for the requirements of the teaching of different disciplines. His work indicated the importance of teaching group sizes and the number of contact hours in the calculation of staff requirements. Though wide disparities continue to exist in SSRs in the public sector, there's doubt at all that this work has proved a useful guide to institutions in planning their own future development.

One might here note that if efficiency in higher education teaching be measured by through-put, with maintenance or improvement of educational standards (however defined - and I shall return to this theme in a second), compared with total cost, then we cannot look only at the total number of teaching staff and the utilisation of them. The project financed by the Department at University College London under the leadership of Professor Musgrove, showed a substantial under-utilisation of premises, because rooms were unused for part of the day or were used by inappropriately sized teaching groups. In short, space had been provided to meet occasional peak loads, and the loading was not as evenly spread as it might have been. This resulted in the development of a computer programme for the matching

of teaching requirements and space availability, which is now available for use in other institutions.

To return to the IMHE programme, the second phase includes a variety of interesting projects. Professor Sizer's comparison of performance indices for teaching at Loughborough University and Lanchester Polytechnic shows a substantial differencw in teaching staff requirements, which is mainly attributable to differences in the size of teaching groups. This out-weighed differences in the proportion of time allocated to research. Larger teaching groups can be achieved through the simultaneous time-tabling of similar modules from various courses, a point to which I made reference a few minutes ago. I shall not go on listing projects, whether undertaken under the IMHE rubric or otherwise. It is however, I hope, clear enough that research so far undertaken indicates that there are substantial economies to be made, without loss of efficiency, in higher education teaching. To achieve them may, I fully recognise, be an agonising process. It is certainly not easier, to put the matter no more strongly, in a period of slow growth than in a period of rapid expansion. Nevertheless, I have little doubt that we must set our hands to the task.

I recognise too that there are problems inherent in the application of any research findings. Many projects are dependent upon the enthusiasm of the individual investigator, and perhaps upon his powers of persuasion with colleagues. It is always hard to know how far research based upon an investigator's own institution or even a pair of institutions is dependent upon particular circumstances at a particular time. Strictly, we should be looking to the exact replication of investigation in several different institutions at different times, but even then, since we are dependant inevitably upon projects mounted by investigators in their own institutions, we may find that there are methodical variations which impair the the overall validity of the findings. Nevertheless, and conceding that we all need to use our judgement in interpreting the results of research projects and applying them to our own institutions, it is reasonable to conclude that our confidence in research findings is increased when we find substantially similar results from projects in dissimilar institutions over a period of time.

Other problems arise from the definition we adopt of

efficiency or cost-effectiveness. It is, of course, much easier to measure resource inputs than educational outputs. Thus, it is relatively easy to show potential economies from larger sized teaching groups. If however one asks if this is cost-effective, one has to be able to measure the output with precision. Output is not of course the same as throughput, namely the number of students taught. We need also to measure the effectiveness of their learning. One might hope to be able to do this by comparing students' degree successes. I however like many others remain to be convinced that examiners' marks are entirely uninfluenced by some notion of the normal percentage pass rate. In any event, fairness to students requires a use of intermediate examinations, progress tests, and informal feed-back, rather than final degree results, when all may be too late. Furthermore, one may question, in inter-institutional comparisons, the legitimacy of collating results between institutions using different instructional methods without allowing for other inter-institutional differences.

In any event, we cannot measure our educational success purely from examination results. I hope that we all still accept that one aim of higher education is the personal development of the student. There are those who would argue that that personal development is best fostered through regular personal contact with teachers and must suffer in less labour-intensive teaching systems. I do not know of any firm evidence that would support that proposition, but certainly it is widely advanced. Again it is difficult to imagine how one might obtain hard evidence. Nothing for example suggests that the personal development of Open University students is inhibited by the OU's teaching methodology - but most of the students have developed in a non-educational context, through their work and more general personal experience. On the other hand, I suppose I can say as an ex-Oxford man, coming from a university which has placed very high reliance on the personal tutorial system, that I have never observed over the years that Oxbridge men have achieved a universally more satisfactory personal development than those educated in other institutions. Again however there might be those who would quarrel with that conclusion.

In all of this I am sure that we should not neglect the perceptions of the consumers, namely the students. I am not of course arguing for that

proposition which, I remember, caused such an upset in the academic world when we were all very young, about 9 years ago. You will recollect that the National Board for Prices and Incomes had the temerity to suggest that students might assess their teachers, and that this might have some impact upon the remuneration of teachers. Only those with starry eyes in an innocent world could make such a wild proposition. Nevertheless, there is a case for arguing that the perception by students of the value of the teaching they receive, by a variety of methodologies, can teach us all a great deal about what is acceptable and what is unacceptable in the drive to achieve a greater efficiency in higher education. I hope that institutions, in considering how they might improve their own efficiency, will not neglect this valuable source of information.

The biggest problem of all in the application of research findings is of course that they are largely unknown to those who should be acting or might be acting upon them. In disseminating research findings, research monographs, whether published in learned journals or in the educational press (the two categories are not meant to be mutually exclusive), or discussed at conferences like this, are not adequate by themselves. We need to ensure that there is guidance to institutional managers and to those teaching within institutions whereby the significance of research findings to their own preoccupations is explained. Here the IMHE programme has made significant advances with the issue of quarterly information bulletins, and occasional professional seminars, as well as the circulation of papers on the United Kingdom projects by the United Kingdom co-ordinating committee among all the participating institutions in this country. None of this however helps the staff of institutions not hitherto associated with this research. We need perhaps to make full use of existing bodies which provide management training for teaching and administrative personnel, such as the FE Staff College and the Regional Management Centres, as well as seeing the development of more courses for university administrators and teaching staff, in both management and teaching methods.

There has never been a more appropriate moment than this to consider not only seriously but with the utmost gravity methods which may enhance the efficiency of teaching in higher education. Our economic situation demands a switch of resources into

industrial investment and exports. The rate of increase in the growth of public expenditure, not least as a proportion of the gross domestic product, must be restrained. Higher education has of course for many years taken a rising share of the education budget, and in consequence a rising share of GDP. The slower rate of growth now predicted for demand for places in higher education eases the problem which the constraint on resources would in any event have imposed upon us. That problem however not only remains with us, but may in the future become yet more serious. It is therefore imperative that we do maximise the efficiency of teaching methods in higher education. If there is no crock of gold at the end of the rainbow, then we shall have to ensure that we maximise in the future the cost-effectiveness of every penny spent. I know that today I am preaching to the converted, but I have every expectation that this conference may contribute to the wider spread of the faith among the infidels.

Efficiency in Higher Education

Leslie Wagner

The latest Public Expenditure White Paper to consider the question of efficiency in higher education announced that over the next four years spending on education in general and higher education per student in particular is planned to fall in real terms. There is clearly to be a squeeze on resources in the immediate future.

Now an economist might be expected to welcome this pressure as encouraging a more cost-effective provision of higher education. Certainly one advantage of a period of stringency is that is makes people more aware of opportunity cost, the principle that the true cost of any action is the next best alternative which has to be foregone. When times are hard, one is more aware of what one has to give up. As more and more claims for limited resources pile up, priorities have to be stated.

On the other hand, the economist would argue that the principle of opportunity cost applies wherever some form of scarcity exists and therefore even when resources are relatively generous the alternatives to any course of action should be considered. There is always an opportunity cost to what one is doing.

Insofar as the present stringency, by increasing scarcity, makes people more aware of opportunity cost, it is to be welcomed. However, there is a danger that the response to this awareness will take the form of mistaking cuts for cost-effectiveness: whilst a move to greater genuine efficiency is to everybody's benefit, there is a danger that moves to economise in times of hardship may result simply in the cheaper provision of higher education rather

than its more efficient provision. The two are not the same and if we are interested in greater efficiency, it is as well that we understand what the term means. On these matters, there is a tendency for policy-makers and administrators to rush in where economists fear to tread!

The concept of efficiency comes from the worlds of technology and economics and concerns the relationship between outputs and inputs. Higher education is seen as a production system which takes a raw or semi-finished product (students) and uses a combination of inputs of labour and capital (staff and equipment) to produce an output (graduates). If there are two methods of production using the same amount of inputs, the one that produces the greater output is the more efficient. Similarly, if two production methods produce the same level of output, the one that uses the least amount of inputs is the more efficient. If we are to measure efficiency, we must be able to identify and measure inputs and outputs and specify the relationship between them.

Outputs

The principle is clear enough. The difficulty comes with application. Let us start with output. What is the output of a university? I implied in the previous paragraph that it was a graduate. Thus we might measure a university's output by its number of graduates. But are all graduates the same? Do we distinguish between first class and third class honours, between medical and history graduates and between doctorates and first degrees? In principle we ought to and in practice it can be done, but there is a much more serious problem.

The output of any productive process is not measured accurately by taking its final output. Rather it is the value added by the process, the difference between initial conditions and final output that is a true measure of what has been produced. One university producing a great many more first class honours graduates than another may not necessarily have a higher output. It is what the university itself has contributed to that output that is important. If it has creamed off those with the greatest intelligence and previous knowledge in a subject, it may have contributed very little to the final achievement. To measure more accurately the value added of the university, we would need to give students a pre-course and post-course test and

allow for other influences on performance besides the university itself. To compare performances in different universities, we would have to produce standardized tests covering a common syllabus.

I do not want to pursue these difficulties further, although attempts to provide tests of this nature in economics in order to compare net output have been made by the Esmee Fairbain Economics Research Centre at Heriot Watt University. Reports on their work can be found in Attiyeh & Lumsden (1971 & 1972). However, I hope this brief discussion has indicated some of the problems of accurately measuring the teaching output of a university. In practice output is usually measured by student numbers or graduates and it is therefore easy to show that if a class which previously had 10 students now has 12, its output has increased. This might well be so, but the more accurate measure is the improvement in student performance. The increase in student numbers might not have affected this performance but on the other hand the extra 2 students may mean less attention being given to the other 10. This may result in lower marks which are not offset by the improved scores of the extra 2 students, so that the average improvement of the class as a whole is less than before. In reality output will have fallen rather than increased. The argument that 'more means worse' therefore need not refer to the lower intelligence of students entering as a result of higher education expansion or divisive arguments about 'pools of ability'. It fits more readily to a situation where expansion in student numbers is not accompanied by equal expansion in resource provision so that staff-student ratios worsen and so on. This may result in more students per £ being taught (ie average costs per student falling) but each student or graduate may be worse than his predecessors in terms of the improvement in his performance resulting from his university attendance.

Let me stress that this would only be the case if the average performance of a class fell as a result of the expansion, ie if the improvement in the extra students' performance was outweighed by the decline in existing students' performance - if, to coin a phrase for my economists colleagues, the output elasticity of expansion was greater than -1. I myself believe that there is scope for marginal changes to staff-student ratios without a deterioration in student performance, so that output in reality as well as falsely measured by average costs will in

fact rise, as I will explain a little later. But the preceding discussion indicates, for those who take the contrary view, the terms in which they ought to be arguing.

However, we have only covered one of the problems of measuring output - albeit a major one. Earlier I defined the output of a university as its graduates and it is significant that this conference is entitled 'Efficiency in *teaching* Methods'. Now as any academic will tell you, universities are about more than teaching. Harry Johnson who, as a Professor of Economics knows all about the problems of measuring output in higher education, has identified three other functions of universities besides teaching, namely: (a) a symbol and repository of 'civilization'; (b) research; (c) information storage.

I will discuss each of these in a minute but consider for a moment the implications for measuring their output of accepting that universities have other functions besides teaching. It means that whilst any of the worthy innovations to be described at this conference might be shown to increase *teaching* efficiency, if it can be shown that they reduce the efficiency of any of the other functions it can be argued that overall *university* efficiency has fallen. Thus deteriorating staff-student ratios might increase teaching output and efficiency but, by reducing research,time might reduce research output and efficiency.

Research

Attempts have been made to quantify research output in order to produce a quantified comparison between research and teaching outputs. Measures suggested have been the number of pages published weighted by an index of journal or publisher quality, a citations index or research grant awarded index. However, these are largely unsatisfactory and my own view is that the evaluation of research output is a qualitative matter depending on peer group judgement.

In practice research output is usually measured by research inputs such as staff and equipment and I will return to the relationship between research and teaching when considering the inputs side. For the moment, let us look at Johnson's two other functions.

Information Storage

Information is stored in universities in libraries and in academics' heads. However, it is difficult to see how this is a separate output from teaching and research. It is better seen as an input helping to produce the other two outputs. Knowledge needs to be stored, so that it can be transmitted through teaching and developed or extended through research. Any increase in knowledge storing should be reflected in increased teaching and research outputs. Knowledge storing might be considered as a separate output if it was made available outside the university through academics appearing in the media or libraries being made open to the general public. If a university library previously open to the general public was forced to restrict their use because of an increase in student numbers, any improvement in teaching efficiency resulting from this increase in numbers would need to be reduced by the loss of knowledge storing output and similarly for any increase in efficiency which resulted from academics working harder inside the university leaving less time for media appearances. I leave you to judge the importance of this loss!

Civilization

Finally, let us look at civilization. The Vice-Chancellor of Lancaster University has no doubts about the fundamental importance of this function of higher education. "The vocational purposes of higher education are incidental and secondary, and could often be provided in other ways. The principal reason why we have universities and colleges is concerned with the extension of civilization, with the rediscovery of man's highest creative achievements, with the need in every generation to question and challenge what has been created and with the excitement of new discovery" (Carter 1973). If Carter is correct, then this is the *principal* reason for universities and if this is largely unrelated to the teaching content, then any efficiency measure or comparison is impossible. As Johnson himself puts it: "In this respect, support of universities is like adherence to a religion or church - the pay-off from so doing is incalculable and problematical, but it is wise to buy insurance against unknown risks" (Johnson 1974).

The analogy is particularly apposite. Where one is buying insurance against *known* risks, it is possible

to calculate the premium required. With unknown risks no rational basis exists for calculating a premium. There is no way of deciding what level of support is required to ensure that the universities' contribution to civilization is maintained and continued. Any level can be justified. Now whilst not even an economist would argue that only that which can be measured should be valued, it is not being unduly cynical to ask why it always seems to be those things which cannot be measured which are valued most.

To summarize on the output side, the most accurate measure of value-added or net teaching output by the university itself is the difference in student performance between pre and post course tests adjusted for influences other than that of the university itself. In practice, students or graduate numbers possibly adjusted for class and level of degree is usually taken as a measure of teaching output. In addition, universities have other functions besides teaching. These must be taken into account qualitatively rather than quantitatively.

Inputs

The inputs side of a university is its costs, and here it might be thought matters are a little simpler. It is true that costs are in general easier than outputs to identify and measure but they still pose a number of problems.

It is necessary to decide whose costs we are talking about. Presumably if we are interested in university efficiency, we include all university costs. However, do we include simply costs incurred by the university (ie excluding fees and other sources of income) or the costs of a particular activity irrespective of how it has been financed? If we are interested in teaching efficiency we must include all the costs of a particular teaching activity. A course which makes students provide a piece of equipment themselves is not necessarily more efficient than one which provides the equipment out of university funds. A rise in students' fees which reduces universities' share of their total costs does not make them any more efficient.

One thorny problem is the students themselves. The output discussion earlier assumed that they were the raw material or semi-finished product on which various inputs worked to produce a final output. In many cases, however, students themselves are inputs.

The improvement in performance may depend as much on their time and effort as that of the academic staff. From the university's point of view, students' time is costless; thus a change in teaching method which involved less staff-student interaction and more student self-learning if it resulted in similar output results would show an improvement in university efficiency. Yet if students' time is valued, all we will have done is to substitute one form of cost for another. Given that students time might be considered less valuable than staff time there might be still be a net reduction in cost. These are important considerations when studying the peer teaching and individual learning experiments discussed in later papers.

Allocation of Costs

Perhaps the most difficult problem of all is to allocate costs between different outputs. Universities can identify their costs by resource (academic staff, administrative staff, laboratories, offices, equipment etc) or by function (science faculty, arts faculty, central administration etc). Various technical problems of converting capital costs into an annual flow of capital services figure need to be overcome, but this is not difficult and so let us assume that the university has data on its annual total costs of producing its various services.

Four types of output were identified earlier but let us assume that civilization and information storage are reflected in teaching and research outputs and concentrate on the latter. Let us also follow what happens in practice and assume not withstanding the reservations expressed previously that teaching output is measured by student numbers.

A frequent practice is to take the annual total cost of an institution, divide it by the number of students to produce an average cost per student and use this as a basis for efficiency comparisons with other institutions. Thus it would be possible to reduce average cost per student (and increase teaching efficiency) by increasing student numbers and devoting a greater proportion of expenditure such as staff time to teaching. The result however would be a reduction in research time and presumably research output. Teaching output and thus efficiency as measured by average total cost per student numbers will have risen whilst research output will have

fallen. As I explained earlier, I do not believe it is possible to produce a realistic measure of research output to enable any quantitative comparison of gains and losses to be made. Any assessment of whether there has been an overall net increase in efficiency of teaching and research outputs combined as a result of such a change will depend on subjective evaluation of the effect on research and value-judgements about the respective merits of teaching and research.

It is therefore relatively easy to show a spurious increase in university efficiency by concentrating resources on teaching whose output is capable of quantitative measurement to the exclusion of research. Average cost per student numbers falls and overall efficiency is presumed to have risen.

There is perhaps some justification in making inter-university comparisons on this basis because it is assumed that all universities devote about the same proportion of their resources to teaching and research. Thus, whilst the figures for average cost per student might over estimate the average teaching costs, relative comparisons between different universities are presumably more accurately based. If we accept student numbers (or some more sophisticated variant such as equivalent under-graduates) as a measure of output and that all universities have the same ratio of teaching to research expenditure, then average total costs per student numbers provides a reasonably accurate guide to *relative* efficiencies. Of course, there is no guarantee that different universities do in fact devote the same proportion of their resources to research. Such is the status of research and its role as some sort of virility symbol that it is difficult to get any university to agree that it spends less of its resources on research than any other.

For this reason, if for no other, a more sophisticated analysis of costs that attempts to allocate them between research and teaching purposes is very desirable. It is *essential* when university costs and efficiencies are being compared with other institutions of higher education such as polytechnics and colleges of education, where the research proportion is likely to be different. Clearly, this allocation is not a simple matter but it is possible as a number of studies have shown (see for example Layard & Verry (1975)).

An assumption of the previous discussion is that teaching and research are competing for the scarce resources of a university's expenditure. But many academics argue in fact that they are joint rather than competing products and that in particular teaching cannot be conducted efficiently without research. We are back to our problem of measuring output because what is at issue here is the quality of output rather than its quantity.

According to this view, all costs are ultimately teaching costs because any resources devoted to research will ultimately have their influence on teaching. A switch in resources from research to teaching to accommodate extra students may increase teaching efficiency in the short run by reducing average costs per student. Even a more accurate measure of teaching output, such as learning gain, might show an increase in efficiency in earlier years. However, over time, as fewer and fewer research findings and inspiration get fed into teaching, learning gain will be reduced and teaching output as accurately measured will fall. However, even this view requires separate allocation of teaching and research costs. For if all costs are lumped together, how is one to determine whether a shift in resources from one type of activity to another leads to a reduction in output as specified above?

To summarise this brief discussion on costs, there is a need to be aware of whose costs are being measured, of hidden costs such as student time and of the need to allocate particular costs to particular outputs.

Inputs and Outputs

Finally, in considering efficiency, there needs to be some knowledge of the relationship between inputs and outputs, what economists call the nature of the production function. A car manufacturer has a pretty clear idea of how much output will increase or decrease if he changes the quantity of his inputs or varies the relationship between them. Knowledge of technology enables him to forecast with reasonable accuracy. The farmer has a reasonable idea of the effect of increasing the use of fertilizers on his crops or the effect of increased feeding stock on his cattle yield. In higher education, we are sadly lacking knowledge of this nature. We can make few if any generalized statements on the effect of smaller classes or larger classes, more individualized

learning, different teaching methods etc, on students' performance.

Well, all I have produced so far is a catalogue of problems which must sound very pessimistic to those who believe that greater efficiency in higher education provision is possible. No doubt those who believe that no useful purpose is served by applying economic analysis to educational issues are suitably encouraged. Let me state quite firmly that this is neither my belief nor purpose. In a moment I will discuss how efficiency might be improved in universities by various measures including those to be discussed at this conference. However, if anything useful is to be said on improving efficiency, it must be based on an awareness of the difficulties of applying such terms to higher education.

Improving Efficiency

Much of what I have had to say relates to trying to obtain an overall efficiency measure of a particular institution or a comparative efficiency measure between two or more institutions at one particular point in time. However, the concerns of this conference and the interest generally in this subject relates to obtaining improvements in efficiency from whatever point we happen to be at as a result of some marginal changes to ways of working, student numbers and so on. To adapt our definition at the beginning of this paper: efficiency is improved if the same output is produced with fewer inputs or the same inputs are used to produce more outputs. We need not be concerned with whether a university overall is 'efficient' in some technical sense but simply with whether a marginal change from A to B results in some improvement. In considering these marginal changes, some of the difficulties outlined earlier can be overcome.

Student Numbers

One way of increasing efficiency is to increase student numbers at a faster rate than university costs. Output per unit of input will rise. It may be possible in fact to increase output to a particular level without any increase in inputs and it is necessary to see how this might occur, bearing in mind the discussion in the first part of the paper.

Let us take inputs first. The main input costs are staff and buildings. A deterioration in the staff-student ratio implies more students per class or fewer class hours per student or more staff time devoted to teaching. If teaching takes the form of lectures, then increasing student numbers up to a particular level produces an unambiguous improvement in efficiency. A larger audience implies neither more work for the lecturer involving higher costs nor worse student performance involving lower output. If the larger audience can be accommodated within the existing lecture theatre, there is a clear improvement in efficiency. Even where some extra costs are involved, it should be possible to organize matters, so that these do not rise proportionately with student numbers. There is evidence for example that showing a lecture on closed circuit television not only involves extra equipment costs but requires more preparation time from the lecturer. However it is still likely that economies of scale will exist.

Where teaching is by tutorials, matters are a little more problematical but some improvement is still likely. The increase may be absorbed by increasing tutorial class sizes. The effect of this on students' performance has already been discussed in terms of the output elasticity of expansion. In other words, will the increase in class size and the consequent reduction in attention reduce total student performance? More precisely, if the learning gain of the extra students is outweighed by any fall in learning gain of existing students from what they might otherwise have achieved, then a fall in output will have occurred. In practice, this is difficult if not impossible to measure, but it is fair to argue that it is unlikely to happen.

However, there may be some increased costs. More students may involve some extra work from staff in essay marking and general counselling and if it is assumed that the expansion of student numbers will not result in staff having to devote more time to teaching, some marginal increase in staff is likely to be necessary. So increase in student numbers in the form of increased tutorial numbers may lead to a slightly lower increase in output and a slightly higher increase in costs than expansion through lectures but should still provide a clear improvement in efficiency.

Another alternative is that extra students are enrolled with no increase in staff, no increase in

class size and no increase in staff time devoted to teaching. The result will be a fall in class hours. A course with 100 students divided into 10 classes of 10 students meeting once a week can expand to 200 students divided into 20 classes of 10 students meeting once a fortnight. Some extra costs for staff will be involved if the number of essays per student stays constant but there should still be substantial savings in cost.

Whether output would be affected is difficult to know. If students can perform equally well with half the staff contact, then all well and good. It is likely, however, that a costly resource (staff) is being substituted by a zero value resource from the university's point of view (student time).

A more likely occurrence is that as student numbers rise with a less than proportionate increase in staff, more staff time will need to be devoted to teaching. I have already commented on this and it is here that a spurious increase in teaching efficiency is most likely to be shown. However, all is not gloom. There is evidence that where staff have to take two classes in a subject whereas previously they took one, some saving in preparation time is shown. So the amount of staff time devoted to teaching need not rise proportionately with the amount of teaching.

The discussion so far has concentrated on staff cost effects of increasing student numbers. However, even if extra student numbers were matched by extra staff numbers, so that class sizes and frequencies were unaltered, there might still be scope for economies through the greater use of buildings. There is evidence from studies at Bradford University that it is possible to increase the size and number of classes without increasing accommodation costs. This involves more intensive use during accepted university hours as well as more extensive use outside normal hours such as the evenings. A more radical re-arrangement of the university year would reap even greater economies.

Much of the discussion of the effect of increased student numbers on class sizes applies equally to science and engineering students. Some differences exist, however. A great deal of science and engineering education takes place in the laboratories. Whilst it is possible to increase student numbers

without any increase or at least a proportionate increase in staff, each student requires his own work area, equipment and so on. Some increase in accommodation and equipment costs is likely therefore.

However, the Bradford studies mentioned earlier showed that the scope for more intensive use of accommodation applied even more to science and engineering courses where as a result of the juxtaposition of the expansion of provision in the 1960s and the falling off in student demand in the early 1970s, a great deal of excess capacity existed. It should be possible to increase student numbers in science therefore without too great an increase in costs.

From all this, it would seem that however strict one's definition of efficiency, it is possible to improve efficiency in higher education through an increase in student numbers and a deterioration of staff-student ratios. Even if staff-student ratios were maintained, efficiency could be improved by the increased utilization of buildings and equipment. Empirical evidence exists on this from studies at the University of Bradford and elsewhere and is conveniently summarized in Pickford (1975).

New Teaching Methods

The other major method of increasing efficiency is through changes in teaching method and this is the concern of this conference. I come to it now, at the very end of my paper, not because I wish to avoid the subject but because I believe that an evaluation of new methods requires an understanding of the meaning of efficiency and it is the latter that has been my main concern. I hope you will be able to apply the points I have made to the various ideas that are presented to you. Perhaps I can concentrate your minds by stressing the important issues as I see them.

New teaching methods are largely concerned with changing input relationships in higher education. Peer teaching may involve the substitution of student time for staff time; individual learning systems require greater preparation time from staff but less ongoing teaching time; distance learning may involve the same factors and in addition economise on accommodation and building costs; inter-university co-operation in course development clearly aims to

spread the costs amongst a larger body of users.

These costings need to be carefully studied. New teaching methods often involve hidden costs, such as increased staff time, which are not correctly evaluated. Costs may be shifted to other agencies and not included in any cost assessment of the institution itself. Where capital equipment is substituted for staff as in computer based or distance learning systems, costs are sometimes incorrectly estimated.

However, the concentration of attention on the inputs side means that the effect on output is sometimes ignored. Studies of new teaching methods tend to assume that student numbers are a reliable proxy for output. It so happens that where attempts have been made to measure the effect on output the results show that new teaching methods at the very least show no loss in output. In many cases where they have been used to help disadvantaged groups of one form or another, a clear improvement in output is shown.

So I end on an optimistic note. Despite the many problems of measuring efficiency, I believe there is scope for improvements in efficiency to the benefit of all concerned in higher education. This can come through increases in student numbers without necessarily any changes in teaching method as I have indicated. Teaching innovation, however, also offers opportunities for gains in genuine efficiency as I hope the papers to this conference will show.

What Makes Teaching Effective?

David Warren Piper

If we pose the question 'what makes teaching effective?' is it sufficient to consider only the teacher in seeking for an answer? I am sure that there is no need to argue the case for answering 'No'. The effectiveness of teaching resides in the effectiveness of the learning which may be attributed to it. What is more, effective learning is dependent upon more things than the teacher. Even where there is a connection between what the teacher does and the student learns it is far from being a reliable cause and effect. We have, therefore, to pose the question 'what makes learning effective?' and for each condition we discover, look for possible concomitants in teaching practice. Thus from the start we are looking at the interaction between teacher and taught; most particularly in the context of higher education, at the interventions a teacher makes in the learning processes, and cognitive development, of her or his students.

A simple rational analysis might suggest three elements which contribute to a student's effectiveness. They are: his or her ability to learn, his or her opportunity to learn, his or her incentive to learn. I will return to enlarge upon those three factors in a moment but let us immediately note that this discussion implies that we might look for expertise from the teacher under three similar headings. For what constitutes effective teaching are three categories of things that the teacher does which, respectively, improve the students' ability to learn, improve their opportunity to learn, and improve their incentive to learn. Perhaps we should note immediately that even in instances where there is clear evidence of just what a teacher *might* do to improve the students' ability, opportunity, or incentive to learn it does *not* follow that he *should* do it. We shall see later there are matters of

economy and other value judgements which may intervene.

To complete a description of the major areas in which improvements in teaching may be sought we should consider the other great interface in an education system, that between the teacher and his teaching institution. If we pose the question 'what makes a teaching organisation effective?' we might seek the answer under three headings. There are those things the institution may do to improve the ability, the opportunity and the incentive of the teachers to teach. As I have divided (artificially of course) teaching into three areas for consideration, it follows that for the teaching institution I have nine categories for considering institutional effectiveness, for the three institutional headings apply to each of the three teaching headings. Again across each of these nine relationships we have to allow for a choice of activity to be made on grounds other than that an improvement in teaching would follow from a given institutional initiative or response.

There we have an outline map of those aspects of teaching and of the educational system in which improvement could lead directly to an increase in teaching effectiveness. The map could also be a curriculum for studies aimed at the improvement of university teaching. It remains only to note that there are some matters which are germane to the whole field but which do not appear in the body of the scheme. Three may be signalled briefly. First: the examination of implicit values. I have mentioned the need for decisions to be made and that these involve the exercising of judgement. The values which inform these judgements should be open to scrutiny not only by the educational philosopher but no less by those who unthinkingly use them and by those who will be affected by them, namely the teachers, the students, and the taxpayer. The discussion of what means might be necessary to admit us all to that debate would fill at least a volume as large as this collection of papers. However, any discussion of effectiveness must eventually entail such judgements, which are essentially political. Second: there is need of a means of monitoring the workings of each of the parts of the system represented in the scheme. It is *not* a homeostatic system although its parts are interdependent. Consequently it needs constant tending and in order to tend any one part, it is necessary to trace the effect on the whole. Third: following from the other two is the need of a language (in its broadest sense) which encompasses

the whole system and which may be shared by those involved in the system. (Another topic worthy of at least its own volume.)

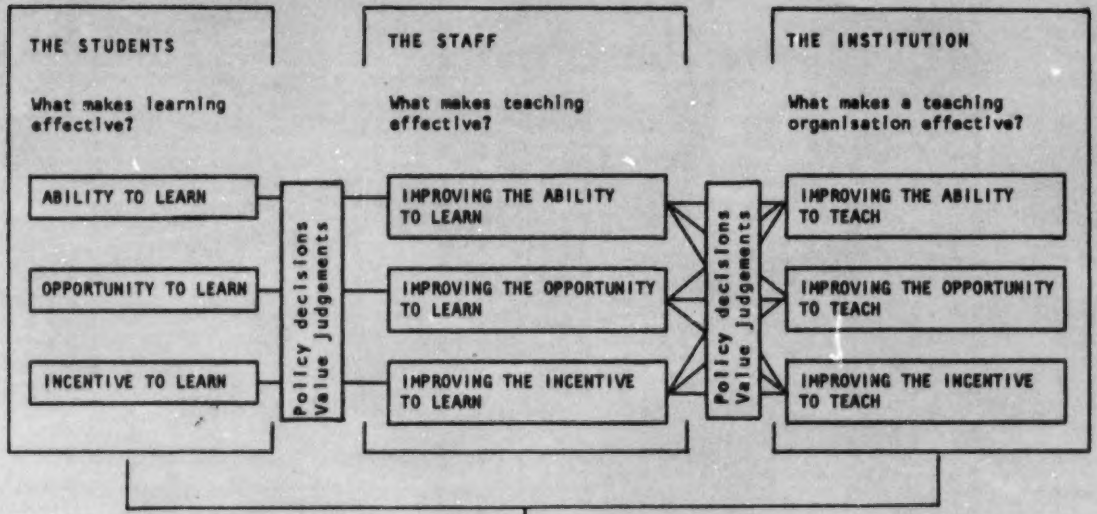
Thus the answer to the question 'what makes teaching effective?' is essentially a diagram (Fig. 1) representing certain ingredients of students, staff and teaching institutions. Each ingredient has its effect; each may be improved.

My purpose in this paper is to indicate briefly some of the issues which may be raised in each part of the diagram. I will dwell rather longer on the subject of improving the ability to learn because it is an important topic recently expanded by advances in cognitive psychology and also by way of illustration of how all sections of the map could be expanded. Before doing so, two points may be made. One: there is nothing inevitable about the way material may be organised inside the suggested framework. Two: what appears in column one (the students) in effect represents percepts of the students which are intended to be illuminating for the staff. There is no final reason why those perceptions should be integrated or, indeed, consistent one with another. One might argue to the contrary: that the greater the variety of ways a member of staff has of perceiving his students and their situation the greater his potential for adaption. What appears in column two (the staff) will largely relate to a possible repertoire of teaching activities. These categories have implications for staff development programmes which may seek to develop in a teacher sensitivity (that is his perceptual 'acuity' and versatility) and a repertoire of teaching methods. Indeed these two educational objectives (for that is what they are) of increasing perceptiveness and widening a repertoire of possible actions occur again and again in development programmes. Combined with a third element they appear as a logical basis for self-sufficiency. The third element concerns self-evaluation, which enables a teacher to substantiate or modify his selection from his repertoire against his purpose which in turn derives from his perceptiveness (Warren Piper 1975).

The Ability to Learn

The ability to learn may be considered under two broad categories: the students' overt behaviour, and the students' cognitive processes. One might suppose that one key to successful studentship lies in good study

Figure 1



Means of examining the values implicit in the system

Means of monitoring the whole system

A language which encompasses the whole system and is shared by those involved in and with the subject

habits. It is not a topic which has been closely investigated. Later in this volume McKay suggests that the time spent in private study is adjusted to compensate for hours of classwork so that the total hours in a working week remains constant. Such findings have implication for timetabling, which in this case would constitute a related entry in the corresponding box in the staff column. (A related matter which might better appear in the 'incentive' box would be the establishment of social norms in the student body concerning the amount of study to be done.)

A second category might be study skills. Behaviourism has taught the efficacy of practising beyond the point of first succeeding in a task, and has shown the potency of testing. The responses which the staff might make to the behaviourist message would include a punctiliousness about the immediacy with which students are given 'knowledge of results', and perhaps a programming of work in small steps. There are other items which might better be described as 'skills of scholarship' rather than study skills. They would include such matters as learning how to get information out of a book, how to take notes, and how to decide priorities of work. These skills are often poorly developed in students; the staff might respond by accepting these 'facilitating objectives' as a legitimate part of university teaching. A student's effectiveness as a learner depends upon his or her ability to work in the way the course requires. Small group work, for example, requires social skills which many students will not have acquired in secondary school. It seems incumbent on a university systematically to help a student acquire those necessary skills which facilitate success.

The many books on how to study focus attention on a selection of study habits and skills of scholarship. Although present day versions may depend less on moral precept than their Victorian forerunners, many have an avuncular tone. Coming from Professor Mace it seems coy: "Have you *surveyed* and asked *questions* about this chapter yet?" (Rowntree, 1976). From D E James it sounds less assuring than one might wish of an uncle: "The first member of each group of chemical elements in the periodic table may be learned in their correct order by putting together their symbols thus:

H. HeLiBeBCNOF

which sounds sufficiently similar to the possible name of an Eastern European person to make memorization fairly easy."

Are these books an effective means of improving an individual's ability to learn? Graham Gibbs has pointed out that the reading of such texts may do little to change the way a student studies (Gibbs 1977). It seems inevitable that the effective response to these learning needs is going to involve a teacher. If the student is unable to learn from books then a book on how to read a book does not seem the most effective remedy. Thus the appeal of the 'learning process consultant' role in which the teacher teaches a student how to learn and encourages him to take responsibility for himself.

The 'process consultant' need not confine himself to advice on overt behaviour. Indeed mnemonics are an attempt at capitalisation on existing concepts well embedded in the memory, while Buzan's diagrams (Buzan 1974) attempt to represent a cognitive structure . A number of texts on 'how to learn' concentrate on helping students realise perceptual changes; 'realise' in the sense that the student not only gains a new percept but consciously explores the difference between the new and the old percept . A common example is getting students to see the difference between what have been variously called 'logical' and 'mnemonic' learning (Goldman 1972), the 'signified' and the 'sign' (Marton 1975), 'real' and 'perfunctory' learning (Northedge 1976).

There is an important consequence of shifting attention from overt behaviour to cognitive activity in the student. For whereas the first might suggest ways in which a staff member may encourage students to work and, possibly, *when* to make interventions in in the students' learning, the second suggests what kind of intervention may be made. We might ask two questions: can the cognitive processes involved in learning themselves be improved? and how do cognitive structures relate to the logical structure of a subject being learned? Each question can lead to different suggestions of what a teacher might do to aid learning.

As always the teacher first needs a percept of 'learning'; in this case of an internal mental process rather than the 'black box' with inputs and outputs with which the behaviourists have supplied us.

Gagné's domains provide us with one useful categorisation. One domain, labelled 'intellectual skills', involve perceptual organisation. These skills, Gagné argues, are not improved by practice (Gagné 1970). Is there nothing then that the teacher can do? Those experimenters and educationalists who have interested themselves in creativeness would say 'yes'. But their purpose would be to lessen the strength (eg Barron 1969). Some claim that versatility in conceptual reorganisation is amenable to improvement with practice (Covington and Critchfield 1965).

Another of Gagné's domains, 'cognitive strategies', has been extensively explored by Bruner. Bruner argues that cognition is an active process and again uses the analogy of a framework or structure into which new information may be either fitted or built. The improvement of memory becomes a matter of the facilitation of retrieval by relating new information to a cognitive structure. The effective teacher becomes actively engaged in helping the student build cognitive structures.

It is at this point that we must enquire of the relationship between a student's cognitive structure and the internal logical structure of an academic discipline. In the mind of the teacher at least, they must presumably be one and the same thing: a discipline is what is understood and taught by the teacher. The student, though, has to understand things his way, build them into his own structures of knowledge. The teaching skill then lies in the negotiations between the teacher and the taught which relate two subjective structures (Bruner 1966).

It is at this point that there is a merger between the two boxes on my diagram 'Improving the ability to learn' and 'Improving the opportunity to learn'. For although providing a basic conceptual structure improves the ability of a student to 'understand' and remember the facts of a subject, providing a student with an understandable account of that subject must surely be counted as part of providing an opportunity to learn. Certainly without it a student would have no opportunity to learn the subject, at least in a compressed university course. Perhaps then, the work of those who take as their focus the internal logical structure of a subject might best be placed in the second row of the boxes in the diagram. An example is provided by Goodlad with his concept of 'authoritative uncertainty'. He argues that the building of a

structure which allows for the identification of what is known is a feature of university level work (Goodlad 1976). He further characterises an academic discipline by its conceptual density (Goodlad 1977). Implicit in this last is a model of the learner as well as the subject matter, signalled by the key words 'conceptual density'.

Bruner and Marton set out to reconcile the model of the learner and the model of the subject matter, which have been separated by the behaviourists. Their success in so doing must be recognised as showing a weakness in the diagrammatic model I have described. However that is not a reason for abandoning it, all models show only some aspects of our concepts. The trick is knowing where they are inadequate.

What responses might the teacher make to *his* conception of his students' conceptions? One is to provide the student with a means of displaying to himself his own cognitive structures. Repertory grids might be one way, a conversation with Gordon Pask's computer another (Pask 1976). As to the teacher's response to a student's misconceptions doubtless Carl Rogers would remind us, with his fourth principle, that threats to a student can be counter productive (in contra-distinction to the behaviourists' healthy negative reinforcement)(Rogers 1969).

Room should also be made in my diagram for the concept of cognitive development, or maturation. As examples: Bruner postulates a hierarchy of modes of learning (enactive, iconic, symbolic) each of which is an advancement on the last; and Perry has provided another view of intellectual development (Perry 1970). All such models have a direct implication for the teacher both in the way he helps a student increase his ability to learn by moving him from his present stage of development to the next and in the way he presents material to be in phase with the student's intellectual development, thus providing him with the opportunity of understanding, as well as he is then able, the subject matter before him.

I hope what has preceded is enough to show how the bare bones of the diagram may be fleshed out. Each point made in the students' column has a functional link with a point in the adjoining box in the staff column (Figure 2). If the student column allows us to display various theoretical models of the student, then the staff column should allow us to deduce a

specification of the effective teacher (not exact, of course, like an engineer's specification, but as good as an occupational psychologist's job specification). However, it is one thing to say that a student or teacher *may* increase learning effectiveness in a certain way; it is another to say that he or she *should* do so. There are value judgements involved, frequently they are judgements about responsibility. An example will illustrate the point.

It is not uncommon to find staff arguing that it is none of their business to teach students how to learn. They ought to have learned that before they arrive. "All our students are both by definition and by selection highly competent and motivated" as one London lecturer recently put it rather wryly (Gretton 1976). If they are not, the implication is, they ought not to be here. Of course, selection is a way of ensuring that the student body possesses an ability to learn. To a degree, and possibly as an incidental effect, the current university selection system does that. But there seems often to be another value judgement being made. That is that it is an interference in the student's privacy to try to help him with the processes of learning. Some might regard the argument as a rationalisation of a reluctance either to become too closely involved with the students, or to master the knowledge and techniques required. Others might regard it as essential to the mutually respectful adult relationship to be fostered between student and staff. No amount of educational research or theory will provide an answer to that dilemma.

Thus it is that for each functional connection between items across the column of the diagram we have a decision which rests not only in its technical soundness (does practice with problems really increase creativeness?) but with its administrative convenience, its costs, and its social and political acceptability.* The diagram may be used to highlight the values behind such decisions.

To continue to explore the possibilities of the map in the detail I have adopted up to this point would test the patience of the reader and make this a disproportionately long paper. Perhaps I may be permitted to hint at the way in which I see such an

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* My endebtedness to Prof. Alec Rodger for these headings is acknowledged in Warren Piper 1965.

Figure 2

The Students	The Staff
ABILITY TO LEARN	IMPROVING THE ABILITY TO LEARN
Overt behaviour:	
Study habits	Setting realistic workload Treatment of study disorders
Skills of scholarship	Identification of key 'facilitating objectives' and a systematic way of teaching students how to achieve them
	Texts on: memory training, speed reading etc
Cognitive activity:	
Improving the mental processes of learning	Teacher acquires an understanding of various models of the mental processes involved in learning
	Expertise in making intervention in the learning process
Enhancing creativeness	Theory and practice of 'creativity training'
Cognitive development	Various models representing stages in intellectual development
	Practice in fitting work to lead from stage to stage

exploration might go by entering headings in the remaining boxes of the diagram.

Four boxes remain in the first two columns although some of the topics which could be arranged in them have already been mentioned. Figures three and four complete the student and staff columns.

Figure 3

The Students	The Staff
OPPORTUNITY TO LEARN	GIVING THE OPPORTUNITY TO LEARN
Knowing what to learn	Subject expertise Clear criteria of learning
Appropriate set activities	Choice of teaching method Expertise in use of teaching method
Time	Timetabling
Facilities	Facilities management

Figure 4

The Students	The Staff
INCENTIVE TO LEARN	IMPROVING THE INCENTIVE TO LEARN
Realistic expectations	Clear briefing of students Agreements on purposes and methods Means of analysing purposes of assessment Repertoire of assessment methods Evaluation of assessment
Social motives Group norms	Expertise in human relations
Emotional equanimity	Counselling - knowing when to refer to a specialist

We have seen that a detailed treatment of the contribution a teaching organisation may make to teaching effectiveness would be arranged under nine headings in figure one. For present purposes we may confine ourselves to three overall headings and ask how the institution may improve the teachers' ability,

opportunity and incentive to teach. All three boxes may be summarised in one diagram: Figure 5.

Figure 5

THE INSTITUTION
Improving the ability to teach
Decide on the level of teaching expertise required Adopt an integrated policy of staff recruitment, selection and training likely to produce that required standard Accept staff development as an aspect of organisational development which as such becomes part of the everyday life and responsibility of teaching departments
Improving the opportunity to teach
Either provide each teacher with a clear brief on what she or he is to teach or give appropriate freedom and support for a teacher to develop her or his own brief and relate it to that of colleagues The institution is responsible for seeing decisions about overall educational purpose are made and that appropriate machinery for making, reviewing and communicating them exists. Who is responsible for what decisions should be clear Staff given appropriate work commitments, time and facilities
Improving the incentive to teach
Having a way of recognising effective teaching and discriminating between good and poor teaching Rewarding effective teaching (accompanied by a way of relieving those who find teaching an onerous duty) Good human relations and the management of people within the organisation Consistent treatment of staff so that expectations are realistic and are met

It will be seen that just as a 'job specification' for a teacher may be derived from an analysis of the students and what makes their learning effective, so a 'performance specification' for the organisation may be derived from a consideration of the teacher. That is the percept of what is required. The various

organisational arrangements which would allow an institution to meet the specification are in effect its repertoire. As individuals can increase their repertoire by experiment and by learning from each other so can universities increase their repertoire. Of course, in the last analysis institutions are the sum of the individuals but some shared perception and co-ordination of action is required. Perhaps a map of the kind suggested here, would be a first step.

The map was offered as a scene setter. To be of use such organisers, as Ausubel (1968) calls them, have to allow us to discriminate new from old ideas, and must be stable and clear. I have pointed to one distinction the diagram makes which is difficult to sustain (that between helping a student build a cognitive structure as an aid to the learning process, and presenting a logical structure of a discipline so as to give the student an opportunity to learn the material). But that seemed an illuminating difficulty. Goodlad suggests that good structures should show us what we do not know. Certainly for me the map throws up gaps in my knowledge and has sent me back to the library with a new set of questions. It also has affected my approach to reading and considering the papers in this collection. I hope you find it worth sharing.

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Towards Greater Efficiency in Teaching and Learning in Higher Education

Marcel L Goldschmid

Introduction

One can distinguish two principal orientations in the current interest in improving university instruction. Largely the result of student dissatisfaction with mass higher education, the first aims at improving the *effectiveness* of instruction. The second, much more recent, and due primarily to the universities' financial difficulties, is directed at increasing the *efficiency* of instruction. Both trends have been reinforced by a rapidly developing educational and instructional technology (cf. Goldschmid, in press).

Upon further reflection, it becomes obvious that the two are interdependent: instruction which is effective, but very costly, is inefficient, inexpensive methods which are ineffective are also inefficient. Thus, I want to make it clear at the outset that I am not advocating 'efficient' solutions at the expense of quality. To simply double or triple the number of students in a lecture hall in order to eliminate a teaching position, for example, is not my idea of efficiency.

What we should look for are *cost-effective* approaches, ie educational practices which at less cost provide the same or better instructional quality, or else strategies which at the same cost are more effective. Both of these goals seem to me legitimate.

Up to now, faculty *and* educational experts have resisted seriously taking instructional cost into account. Proposals for teaching innovations, for example, have almost always been accompanied by requests for additional funds. Now that investments in higher education are being curtailed, but student numbers remain high, the search for more efficient

solutions has become urgent.

Three broad areas for improvement will be considered in this paper: faculty performance, student learning, and institutional organization.

Faculty Performance

The selection of academic staff is based primarily on their subject matter expertise, but hardly ever on their training in teaching. Nor has the career structure of professors up to now encouraged commitment to teaching after they are appointed, since status, promotion, and tenure depend largely on research contributions. But even if one values research more highly than teaching, the fact remains that most faculties devote a good deal of their time to instruction. If they are not trained and prepared for this activity before nor after they are hired, how can they be efficient?

One way to enhance efficiency in teaching, then, is to train professors and help them acquire instructional skills and expertise. Fortunately, many universities all over the world have recently come to realize the importance of faculty development (cf. Astin, et al., 1974).

Efforts in improving faculty performance have concentrated on the creation of comprehensive evaluation systems, the establishment of pedagogical service units and the development of courses in instruction.

These efforts have been accompanied and aided by an increasing number of articles and books (for example Axelrod, 1973; Buxton and Pritchard, 1975; Harding and Sayer, 1975; Huberman, 1973; Kourganoff, 1972; Lee, 1970; Lehrer, 1970; Mackeachie, 1969; Mackenzie, et al., 1970; Mansell, 1975; Morris, 1970; Najman, 1974; Page, 1974; Reif, 1974; Sheffield, 1974; Unesco-IAU Seminar, 1971), new journals, and national and international conferences, all devoted to university instruction.

1 Evaluation of Teaching

One way of increasing one's efficiency is to seek objective and continuous feedback by those who are directly affected by our performance. Such feedback is being sought increasingly: questionnaires on the quality of teaching completed by students have

become almost commonplace on many campuses. Increasingly, deans, department chairmen, and faculty committees are considering the results of these assessments in decisions involving tenure and promotion.

Video recording of classroom performance is also becoming popular as a means to improve instructional effectiveness (cf. Perlberg, 1976).

This is not the place to go into details of teaching evaluations (cf. Costin, et al., 1971; Miller, 1972), but it is important to underline here that while they constitute a necessary source of information, student ratings are *not* sufficient to improve one's teaching efficiency. Two other factors must be considered as well. One is student learning, and the other the use that is being made of this information. The first one is more obvious: a high faculty rating without corresponding evidence of student learning is hardly satisfactory. We shall discuss the second factor in more detail in the following sections.

2 Pedagogical Service Units

Besides knowledge about one's teaching defects one must also have access to information and training on how to improve one's performance. Unless faculty can and do act upon the feedback they receive through student evaluations, for example, there is no assurance that their efficiency will be improved. They must have real opportunities to become *professionals*, not only in their discipline, but as teachers as well.

An increasing number of colleges and universities are in fact setting up pedagogical service units (also called university teaching methods units, instructional institutes, etc.) to help meet the need for faculty development. (Estimates run as high as 500 centres in the United States alone (Semas, 1975); in Europe, Australia, and New Zealand there are now numerous pedagogical service centres as well.)

Besides courses on teaching and learning (which we shall consider separately in the next section) these units offer *consultations* on a variety of pedagogical problems.

For example, they might advise individual faculty members on:

- the selection of an appropriate teaching method for a given course;
- the development of the curriculum and formulation of objectives;
- the creation of a positive classroom climate and rewarding interpersonal relationships with students;
- the integration of various portions of their courses (eg lecture, laboratory, project, etc);
- teaching innovations developed elsewhere which the professors would like to try out in their own courses;
- and so on.

Another function of the units is to collect *information*, documents, books, journals and media *on instruction in higher education* and make them available to the faculty. Some of the units issue their own newsletter which they distribute to all staff members. Perhaps one of the most effective approaches is to ask staff members from various departments to report on their teaching practice, experimentation, innovation and evaluation, in seminars and conferences. The impact is often greater when the information comes from the faculty's colleagues on the same campus.

Most pedagogical service units play an important role in developing and running the *teaching evaluation* system on their campus. For example, they may produce a questionnaire, a computer based scoring procedure, and sometimes norms and a manual. They are also consulted on special evaluation problems in particular courses and programmes.

Advising academic units (departments and faculties) and the *administration* is still an underdeveloped but potentially very useful function of pedagogical service units. At this level, the units could be called upon to help resolve more global teaching problems such as a program for first year students, an entire curriculum for a department, student work loads, and promotion and tenure procedures. Their principal role should be to advocate policies and institutional structures which enhance instructional efficiency. In this capacity, they may also service, on and off campus, various committees related to teaching and learning.

A final role of these units, which should be mentioned

here, concerns their *research activities*. Pedagogical service units should constitute a valuable resource for experimentation with and evaluation of innovations (cf. Goldschmid, 1975, for a brief description of the activities of one, and Alexander and Yelon, 1972, of several of these units).

It is obvious that these units must have the confidence of the faculty, but it is equally important that they have direct links with top administrators in order to enhance their influence on policy decisions concerning instruction.

3 Courses on Instruction

As already mentioned, one of the activities of the pedagogical service units is to provide the faculty with opportunities to learn more about the instructional process. Even in the absence of such a unit, many universities now organize seminars, workshops, courses, and conferences on university teaching (cf. Greenaway, 1971, and Harding, 1974 for a description of these offerings in British universities and polytechnics, respectively). They vary in content and format from two hour seminars on specific teaching problems to one year courses on the entire instructional process and represent an efficient means to provide a large number of faculty at least with the basics of university instruction.

In a recent evaluation of such courses* over three hundred staff from eighteen British universities completed a questionnaire on their experience. A first analysis by King (1973) showed that very few had had any training before, and most were worried about the lecture situation. Riley (1974) summarised the results of a second analysis as follows:

" (a) the majority of the participants who responded were appreciative of the training course offered for university teachers;
(b) just over half felt that such courses should have compulsory attendance;
(c) a measure of inter-disciplinary and inter-university courses was recommended;

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* *Rothman and Robinson (1976) have carried out a comprehensive evaluation of the university-teacher training course offered by London University's Teaching Methods Unit both immediately after the course and four months later.*

(d) there was considerable support for the view that experienced staff should be encouraged to attend as full participants;
(e) the majority felt that they would appreciate advance material, including work to prepare for the course;
(f) there was a clear preference for one week courses to be held in September/October."

As I have mentioned on a previous occasion (Goldschmid in press), in order to be successful, all efforts to improve faculty performance require institutional commitment, time and resource allocations, as well as incentives such as "promotion and salary improvement to faculty who contribute to the advancement of instructional technology" (Carnegie Commission on Higher Education, 1972).

Student Learning

Efforts to increase teaching efficiency by improving faculty performance should be accompanied by attempts to develop the learning skills of students. Much as in the case of effectiveness and efficiency, there is a close interdependence between teaching and learning.

While we can improve the students' opportunities to learn by better teaching methods, we can also more directly help students develop their learning skills so that they can take maximum advantage of the opportunities offered. For example, many professors have observed that if they change from a lecture format to small group discussions, many students are unable to fully participate. They may lack skills in verbal expression and group dynamics, or self-discipline to prepare for the sessions. Or when the instructor offers the possibility of doing a project in his course, he may discover that students have difficulties in organizing their time, deciding on a topic, and writing a report.

Those examples could easily be multiplied and represent common difficulties a professor has to face when he introduces a new option. Nor are the more traditional methods exempt from these problems. For example, in a lecture situation many students do not know how to take adequate notes and prepare for an exam. The point is: in order to achieve maximum results, efforts to improve the teaching efficiency of the professors must go hand in hand with attempts to increase the learning efficiency of the students.

In the following, we shall consider several possibilities to improve the students' learning skills in a more direct form.

1 Student Learning Services and Courses

Parallel to pedagogical service units and workshops for faculty, universities might consider offering services and courses on learning for students (cf. Byrne, et al., 1975). Perhaps staffed by more advanced and successful students, such services could provide consultation on various learning problems and offer practical courses and tutoring on a number of subjects, such as taking notes, preparing a report, participating in a group and carrying out a project. Such an approach might be more efficient than trying to teach these skills exclusively in subject matter related courses, where the time available for non-content oriented activities is usually very limited.

2 Individualized Instruction

In order to give more responsibility to students and offer more opportunities to learn efficiently, there has been a strong movement in the last ten years in higher education to individualize instruction. Various formats have been developed, PSI probably being the most popular one. They are all learner- rather than teacher oriented and emphasize clear goals, active student participation, continuous evaluation and immediate feedback, and most importantly, individual pacing.

We need not go into details here, since reviews on this topic are available (Goldschmid and Goldschmid 1973; 1974). In general, students work through a unit (usually a specially prepared written document, sometimes accompanied by multi-media systems or computer programmes) often with the help of student assistants. When they believe that they have mastered the unit's objectives, the students take an exam and receive immediate feedback on their performance.

On the whole, the evaluation of these systems has been very favourable. They represent an effective and flexible instructional option which can also be very efficient, particularly after the rather expensive development phase and when it is used with large numbers of students.

3 Peer Teaching

Another possibility to increase the efficiency of student learning and one which we have hardly begun to explore is peer teaching. Students themselves represent one of the most underused teaching resources in higher education. In peer teaching, students basically teach other students of approximately the same age and educational experience, but a number of models which vary in their application of this principle have evolved. I shall briefly describe some of them and for more details refer you to the review we have recently completed (Goldschmid and Goldschmid, 1976).

Discussion groups, seminars, and tutorials. Many universities have decided to supplement large lecture classes with small discussion groups in order to increase student participation and facilitate the assimilation of the lecture material.

For pedagogical or more often financial reasons they have on occasions employed undergraduates as teaching assistants or tutors either for a small salary or additional course credit.

Proctoring. Particularly in PSI and other types of individualized instruction, undergraduates have been employed to supervise the work of a group of fellow students. They take an active part in advising them and evaluating their work.

In *Student Learning Groups*, which are small instructorless or self-directed groups, participants themselves (undergraduates) represent the main instructional resource. They offer a great deal of autonomy and opportunities for active participation.

The Learning Cell or student dyad refers to a cooperative form of learning in which students alternate asking and answering questions on commonly read materials (Goldschmid and Shore, 1974).

'Parrainage' or Student Counselling. At our Institute we are currently experimenting with a form of peer teaching which goes beyond the confines of a particular course (Goldschmid and Burckhardt, 1974). In their first year, small groups of freshmen are assisted by a senior in any practical difficulties they might encounter (housing, transportation, stipends, etc.) as well as in the preparation for

their courses and exams.

Peer teaching represents one of the most efficient innovations in higher education. It usually does not require additional financial resources, yet enables students to more actively participate in their learning experience and develop personal contacts with their peers. Research has demonstrated that peer teaching is beneficial both cognitively and affectively for student 'teachers' and student 'learners' alike.

Institutional Organization

Much could be said on this topic, but I shall have to limit myself here to a few examples.

1 Coordination of Interventions

Lindquist (1975) has identified four strategies currently employed for improving university teaching.

In the 'problem-solving model', a consultant together with a professor or a group (faculty, students, administrators) diagnoses a particular teaching problem and seek a solution.

The 'linkage-to-innovation model' begins with the awareness of a teaching innovation rather than the faculty's identification of a need to change. 'Show-and-tell' events are arranged for the faculty to learn more about the innovation. A pilot programme may then allow the faculty to try out the innovation in their own courses.

The 'research and development model' makes use of a combination of basic and applied research, and the development of specific techniques.

The 'legitimate authority model' relies on the administration's power to influence personnel decisions (selection, promotion and tenure) to pressure faculty to change.

Some of the advantages and problems of each of the four strategies are summarized in Table 1.

Table 1

Advantages and Problems of four Strategies for Improving University Teaching (adapted from Lindquist, 1975)

Model	Advantages	Problems
Problem solving	- emphasizes faculty autonomy - produces identification with one's solution - is sensitive to the needs of students - encourages collaboration with others	- encourages myopia or reinvention of the wheel - resistance to techniques which are not empirically validated
Linkage to Innovation	- broad information is used - innovation is a stimulus and reassurance for change - opinion leaders can help expand applications of the innovation	- interest depends on a particular innovation - timing problems in the linkage process - organizational and implementational problems - resistance to borrow someone else's invention
Research and Development	- coordination of basic and applied research and development - different skills are accumulated	- adoption of a new approach does not necessarily follow even after an experimental project has shown its merit - diffusion effect may be insufficient
Legitimate Authority	- produces pressures to change - 'official' sanction facilitates adoption and diffusion of innovations	- lack of commitment - resistance to authority - makes people defensive

According to Lindquist, however, none of these strategies sufficiently emphasize the *implementation* phase. It is not enough to adopt or develop a new teaching approach; the change must be sustained and the new procedure evaluated, revised and assimilated.

For greatest effect, Lindquist advocates the *combined* use of all four strategies. He points out that each can serve to amplify and solidify the others, especially if they are used at all three organizational levels - the individual, departmental, and institutional ones.

The coordination and concerted use of several strategies to improve teaching thus represents one way to increase efficiency at the level of institutional organization.

2 Departmental Teaching Consultants

One may wonder how the typically small staff of a pedagogical service unit can provide the intensive and long term individual help a large number of faculty may need to really make significant progress.

Indeed, this is one of the most vexing problems of these units, since they are engaged in many activities, confronted with a variety of pedagogical problems and always understaffed.

One way out of this dilemma and a means to improve the efficiency of pedagogical service units might be to create a group of unit associates. These associates would be recruited among regular academic staff members. It should not prove too difficult to identify at least one faculty member in each department who especially enjoys teaching and has already experimented with various instructional forms.

These professors would then get special and intensive training by the unit and stay in regular contact with it. In turn, they would become teaching consultants in their own departments. Such an approach would not only in effect expand the staff of the pedagogical service unit, it would have the additional advantage that these associates would be teaching experts *and* subject matter specialists and therefore most valuable to their colleagues who can count on their comprehension of their subject matter as well. Furthermore, they are in touch with departmental programmes, priorities and politics and can therefore better gauge their interventions than 'outsiders', ie,

members of the pedagogical service units.

The major problem in implementing this plan is to find an appropriate incentive for this additional activity. It could be in the form of a salary increase or promotion, or a reduction in the teaching load.

Another approach would be to recruit senior faculty members who no longer have to worry about tenure, but who have considerable experience in teaching and influence in their department.

3 Organizational Structures

A number of aspects in the organization and structure of courses and programmes also merit a close look with respect to possibilities for improvement.

For example, many European universities, which still 'promote' their students on an annual or semestrial basis (yearly or semestrial grade point average) would do well to explore the more efficient *credit system* which is widespread in the United States.

One might also consider *intensifying and concentrating the educational experience* in fewer courses per term (eg, three five-hour courses per week) and the possibility of doing more out of class work as opposed to the more fragmented approach currently used in Europe of offering many courses each term (eg, ten to fifteen two- or three hour courses per week) with a heavy emphasis on class work.

A quarter system which would permit a *year-round operation* without limiting the faculty's research activities might also be investigated.

Integration of recurrent education with regular degree work is also called for. As of now, the two operations are still largely separate. With an increasing emphasis on adult education and 'education permanente', universities would do well to streamline their programmes and facilitate passage from one to the other.

The *orientation of students* with respect to courses, programmes, teaching methods, options, etc, should be improved. Too often students *are* left to their own devices to figure out what their campus is all about. As a result, valuable time gets lost, inadequate choices are made, and numerous resources which *are* available remain unexplored and unused (cf. Cope and

Hannah, 1975).

4 Cooperation in the Development and Exchange of Software

A final area which we shall consider and which cries out for a more efficient approach concerns the production of software and course materials. Be they computer programmes for CAI, slides, films or video-recordings, faculty almost invariably create anew their own software for their courses. Thie represents a costly exercise; in addition the quality of the production is often unsatisfactory.

All kinds of cooperation within a department, a university, nationally and internationally can be envisaged. While the adoption of texts written by another professor no longer presents major problems, we have yet to create an efficient information and distribution system for computer programmes and media in higher education which would allow university teachers to select and adapt materials, produced elsewhere, for their own courses.

Conclusion

Faculty performance, student learning skills, and institutional organization constitute some of the areas where the university's efficiency in teaching and learning might be improved.

If our goal is to develop and adopt cost-effective instruction, we must arrive at valid comparisons among different methods and institutional structures both with respect to cost and effectiveness. Precise data on these aspects are not currently available. In fact, universities are now often unable to even specify cost of traditional methods.

In cooperation with administrators and faculty, teaching and learning experts must devote some of their energies not only to evaluating the effectiveness of a method or organizational approach, but also its costs, to arrive at valid conclusions with respect to efficiency.

To conclude, the demand to better respond to the students' and society's needs, coupled with the pressure to become more efficient, constitute a formidable challenge to the modern university.

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On Defining Quality of Education

Hans Crombag

An important distinction

Frequently, when faculties are faced with the necessity to economize on their expenditure - especially the size of their teaching staff relative to the number of students - they warn that a decline in the quality of education is likely to result. Let us examine what might be the meaning of the expression 'quality of education' in this context.

One might be of the opinion that the quality of education can be defined in terms of the objectives which are reached through education. I think that this is a confusing definition of the concept of 'quality of education'. In order to explain this, let us consider a simple example. Suppose a faculty has to close down a number of teaching posts. What could a faculty do to make up for this loss? The following possibilities might be considered:

a) the educational objectives are lowered: less subject matter is covered, or the same amount is covered with less depth, or there is a combination of both,

b) the curriculum time is lengthened: for the same number of students and the same objectives more time is used;

c) the same curriculum is taught to fewer students;

d) the loss of manpower is rectified by withdrawing personnel from other tasks, such as research;

e) a number of possibilities for the specialization of students is abolished, and the faculty concentrates on conservation of the remaining parts of the curriculum; this is a variant of possibility d);

f) the efficiency of the teaching methods used is heightened in order to reach the same objectives for the same students in the same time.

Apart from possible combinations of the measures listed above, these seem to be the possibilities. Since a decrease in manpower is frequently linked directly to a decrease in the quality of education, let us consider which of the above mentioned measures imply a decrease in the quality of education. Let us first look briefly at the measures (d) and (e). Measure (d) would only temporarily result in alleviation of the problem. In the long run it would certainly have a negative effect on education. Measure (e) could be interpreted as affecting the quality of education, as defined earlier, but it could be compensated by a division of labour among different universities.

Measure (b) may be reformulated as: lowering the number of students per unit of time. Measure (c) is equivalent to the introduction of a numerus fixus, the simplest and most often chosen way out, which, however, has serious social drawbacks. Both measures (b) and (c) seem to solve the problem of maintaining the quality of education, but they displace the problem rather than solve it.

Let us consider measure (a). It seems to me that with respect to measure (a) we could better speak of lowering the *quality of the graduates*. The concept of quality of the graduates should be distinguished from the concept of quality of education. This becomes apparent when we consider the measures (b) and (f). Considering measure (b) we could say that the quality of the graduates remains unimpaired, while the quality of education declines since the costs (in terms of time used) per student go up. Measure (f) could be said to result in a heightening of the quality of education, since the same number of graduates of the same quality is reached for lower costs.

The expression 'quality of education' has an ambiguous meaning in common parlance. I therefore propose to use instead the expression 'efficiency of education', and to distinguish this concept from the concept of 'quality of graduates'. I define 'quality of graduates' as the average amount of subject matter and the depth in which it is mastered by the graduates. I define 'efficiency of education' as the ratio of the average quality of the graduates

and the average costs per graduate - costs made by the educational institution as well as by the student.

When faculties warn that the quality of education will go down as a result of the necessity to economize, what they really mean to say is that the average quality of the graduates will decrease. That will indeed be the result if measures as indicated under (f) are not possible, ie if the education given is already optimal in efficiency. On the problem of optimization I will comment later. Let me first elaborate on the concept of 'quality of graduates'.

The quality of graduates

I have defined quality of graduates as the amount of subject matter learned and the depth in which it is mastered by the students. Let me try to elaborate on this definition. I propose to express the amount of subject matter to be learned in the number of pages of books and syllabi to be studied - obviously some sort of standardization has to be done to make up for the varying number of words per page. I realize that this proposal constitutes a serious simplification of the problem. Books differ in difficulty level and degree of redundancy of presentation of subject matter. Moreover, to study a page in a book may mean a detailed memorization of its content, but it may also mean extracting only the core of the argument. Still I propose, for the time being, to simply count the number of -standardized- pages. As I shall argue later, for the definition of 'quality of graduates' it would not make much of a difference to discriminate between different kinds of books and different ways of studying books. Let us, for reasons of simplicity, for the time being think of the amount of subject matter as being expressed in the number of pages to be studied by the students.

I come to 'depth of mastery of subject matter'. I propose to express this component, in part, in the number of different tasks students are able to perform after education. If we define a 'task' in this context as 'any relatively separable total of mental and/or psychomotor operations', it may comprise a simple task like saying something in one's own words as well as complex tasks like writing an essay or performing an experiment. It is essential that we count the number of different tasks graduates are able to perform successfully. Again this is a gross simplification: tasks may differ enormously, and

it seems senseless to add tasks which vary greatly in difficulty. One would measure with a varying unit of measurement.

One could try to remedy this problem by breaking up complex tasks into more simple partial tasks. This may result in a more equal unit of measurement. Doing this in practice would probably pose many problems, but in principle it can be done, and in theory it works. Counting tasks which graduates can perform successfully does not completely solve the problem of defining 'depth of mastery of subject matter'. In many instances the learning experiences of students cannot be broken down into separable tasks, because they are too little well defined and, moreover, are different for different students. I am referring to periods of practical work and taking part in research projects. A first year practical course may be described adequately in terms of the number of experiments the student has to be able to perform during that practical course, whereas the learning experience gained by a student taking part in the research project of a staff member can only be expressed in terms of the length of the period for which the experience has lasted. In theory there is no objection to adding to the already mentioned two components of the concept of 'quality of graduates' a third one.

To sum up. The quality of graduates can be expressed in terms of the following components:

(a) the number of standardized pages of subject matter to be studied;

(b) the number of different tasks the students can perform successfully;

(c) the length of learning experiences, which cannot be broken down into a set of separable learning tasks.

Differences in the average quality of graduates at different points in time can therefore be expressed in terms of proportional differences in one or more of the components of quality of graduates (or as the distance between two points in a three-dimensional space).

Some remarks should be added to the foregoing. First it should be mentioned that the foregoing analysis is applicable to curricula as a whole as well as to

parts of curricula. The second remark is, that the three components of quality of graduates probably cannot vary completely independently from each other. Reducing the knowledge-component may lead to a necessary reduction in the other two components, because parts of the components may become impossible without a certain amount of knowledge.

The third remark is, that the three components cannot be considered to be continuously measureable variables. Suppose one starts reducing the knowledge component by reducing the number of pages to be studied for a course. For some time this can be done gradually: one takes off 50 pages, or even 100. At a distinct point reducing further means that the whole course becomes impossible. In other words going under a critical number of pages the only possible remaining value of the component is 0. At the same time this would imply that all tasks belonging to that course would become impossible, which illustrates once again my second remark.

The fourth remark, finally, is that if one were to decide to divide one or more of the components of quality of graduates into two or more separate components, there would be no fundamental objection against defining the quality of graduates at a particular moment in time in more than three components. The definition in principle remains the same.

Efficiency of Education

In the first section I have said that a decrease in manpower will necessarily result in a diminishing average quality of graduates only if the efficiency of the educational programme is optimal. In this section I shall occupy myself with the question: when is efficiency of education optimal?

The word 'optimal' indicates that deviations from optimality in two directions are possible: there may be over and under investment. Obviously, there is no such thing as the one best teaching method. Which teaching method is optimally efficient depends on at least two things:

(a) the educational objectives one tries to accomplish, ie the nature of the subject matter and what one wants the student to be able to do with the subject matter; and

(b) the kinds of students one is teaching.

Empirical evidence to answer the questions (1) which teaching methods are most efficient for reaching particular objectives, (2) which teaching methods are most efficient for different types of students, and (3) which teaching methods are most efficient for varying combinations of students and objectives, is only available fragmentarily. And to the extent that there is evidence at all, it is frequently negative in the sense that the outcome is that it does not make much of a difference which teaching methods are used for which objectives (see eg Dubin & Taveggia, 1968), and what teaching method is used for which kinds of students (see Cronbach & Snow, 1969).

Differences between students

Let us consider first the research done concerning the question of whether some students learn better when approached with certain teaching procedures, while others do better with other teaching procedures (aptitude-treatment interaction studies). Results have until now been mostly negative: it does not make much of a difference. Does this mean that it is possible to present the subject matter in the same manner to largely different groups of students? Is it possible, for instance, to teach set theory to first grade secondary school pupils in a way similar to that which was traditionally used with first year university students? This seems highly improbable - so improbable that nobody has been willing to put it to the test. The differences between the two groups in the example seem at first sight so large, that the hypothesis that they require a different educational treatment appears trivial, too trivial to be tested.

Researchers prefer to test less trivial hypotheses, for instance whether differences between students in a particular faculty make a different educational approach desirable. University students in a particular faculty are, however, a rather homogeneous group: by means of secondary education they are highly selected on the basis of their abstract-verbal intellectual abilities and their persistence in intellectual tasks. That is done intentionally. Moreover, a certain unintentional selection according to socio-economic background has taken place. In addition a certain self-selection through choice of faculty has occurred: students good at mathematics enter the science faculties, students good at languages enter the language faculties, etc (see

Gaff, et al., 1973). If one adds to this the strong resemblances in interests among the students in the same faculty, it becomes clear that a good many of the negative results, mentioned before, are due to the fact that researchers prefer to study non-trivial hypotheses. As a result many studies take the form of investigating whether marginal differences among students belonging to highly homogeneous groups still make a difference large enough to justify different educational procedures.

During the rest of this paper I therefore propose to ignore differences between students. Discussing optimization of efficiency of education, let us assume that the optimum for all students lies at approximately the same point.

Differences between teaching methods

Studies in which the efficiency of different teaching methods were compared have frequently yielded negative results. This type of study is mostly designed as follows: a group of students is randomly divided into two groups; to one of these groups a particular part of the subject matter is presented by way of method A, to the other group the same subject matter is presented by way of method B. Afterwards all students take the same test, and the average scores of both groups of students are compared. Almost invariably the difference is small, and at one time it lies in one direction, at another time in the other direction (Dubin & Taveggia, 1968).

Again these negative results are to a large extent due to the fact that researchers are inclined only to investigate non-trivial questions. The question whether skill in designing a mechanical construction can be acquired equally well by means of a lecture course or by way of a series of exercises is something nobody wants to investigate: obviously it makes a difference. For particular parts of the subject matter and/or particular teaching goals some teaching methods are evidently not applicable. Researchers are only willing, given a certain part of subject matter and certain objectives, to test *reasonable alternatives*. Since we know from empirical research that, within the limits of such reasonable alternatives, it does not make much of a difference which alternative is chosen, what remains to be done is to discriminate between each type of subject matter and/or teaching objective in the search for

reasonable and unreasonable alternatives, and among reasonable alternatives to indicate the cheapest.

Educational Objectives

In the foregoing we have used 'subject matter' and 'educational or teaching objectives' interchangeably. The problem in using these words is, that it is uncertain whether educational objectives can be generalized over subject matter areas. Is it possible to use a concept like 'knowledge of subject matter' in general, or do we have to discriminate according to discipline? Do knowledge of history and knowledge of physics have something in common irrespective of the differences in content? If so, one may ask whether it is possible to indicate teaching methods optimal for transmitting knowledge, and others which are optimal for teaching comprehension, etc.

However, if comprehension in one discipline has little in common with comprehension in another discipline, then statements concerning optimal combinations of teaching methods and teaching objectives have to be made separately for different disciplines.

For reasons of simplicity I propose to assume for the time being, ie for as long as it does not lead to obviously incorrect conclusions, that teaching objectives can be generalized over different subject matter areas. Moreover, I propose to divide educational objectives into three broad classes of objectives:

(a) Knowledge: Knowledge means the ability to reproduce what has been presented earlier in education (lecture, book, etc). In all instances in which we are satisfied with at least literal reproduction of what was taught, we speak of knowledge. Knowledge may concern a simple specific fact, eg the name of the designer of the theory of evolution, but also complex sets of interconnected propositions, eg the theory of evolution itself.

(b) Comprehension: By comprehension I mean the ability to change the form of some information presented earlier without changing its content. If comprehension is our objective we are not satisfied with verbatim reproduction, because it is possible for a student to rote memorize the information (the

fact that students rarely do that with complex information is not a case in point: it is the principle that counts). When we have comprehension for an objective, we want students to demonstrate this by changing the form without changing the content of the message.

(c) Application: We speak about application if we want the student to connect his knowledge and comprehension with the observable reality, if we want him to be able to treat a concrete instance using his knowledge. Application of knowledge may emerge in a rather trivial manner out of knowledge and comprehension. For instance we give a student the definition of the diagonal in a rectangle. Application of this knowledge may simply involve drawing correctly the diagonals in a given rectangle. Application of knowledge may be less trivial: we can instruct students on the symptoms of a particular disease, their interrelations, frequencies of occurrence, and so on. Using this kind of knowledge in diagnosing a patient is a far from trivial extension of the available knowledge.

Teaching Methods

An attempt at indicating optimal combinations of teaching objectives and teaching methods may be started at either of two sides. One could start from the objectives, as defined in "Educational Objectives", and indicate for each the most efficient teaching method. This approach does not appear to be the most advisable one because the objectives have only been categorized very crudely.

The other approach is to sum up all possible teaching methods, and to indicate for reaching which objectives each is most efficient. In this paper I shall use this second approach. In doing this I have looked for inspiration at a similar summing up made by Dr J Vastenhouw of the Technological University in Delft (mimeographed paper). Perhaps it is better to speak about elements of teaching methods, because in practice all sorts of combinations occur. I propose the following classification of elements of teaching methods:

1	*Lecture*	1.1 *Systematic lecture*: the subject matter is presented orally in a systematic way to a relatively large group of passive students. 'A spoken book' one could say.

1.2 *Commentarial lecture:* subject matter, already available in written form, is commented on and explained. Essential is that the teacher does not strive for complete coverage of the subject matter.

1.3 *Capita selecta:* selected topics, which are not completely available to the students in any other form, are discussed in a systematic way. It usually concerns new developments and/or a personal approach of the teacher.

1.4 *Discussion class:* subject matter, studied in advance by the students, is discussed with relatively large groups of students. Either the students ask questions (question hour), or the teacher puts questions to the students (socratic method).

2 *Reading*

2.1 *Passive study of books:* handbooks or syllabi, containing the subject matter completely and in a systematic way, are studied.

2.2 *Active study of books:* studying books is accompanied by exercises independently made. Exercises may be part of the book or put in a separate student workbook.

2.3 *Study of literature:* original monographs and articles are read. This may concern prescribed lists of readings, or readings chosen by the students themselves.

3 *Exercises*

3.1 *Practical course:* series of practical exercises, designed and programmed by teacher, executed individually.

		3.2 *Working group:* series of exercises, designed and programmed by teacher, executed in groups.
		3.3 *Project group:* exercise(s), not designed by teacher, executed in groups.
		n.b. Not programmed, individually executed exercises are mentioned under (5).
4	*Practical experiences*	4.1 *Excursion/observation:* observation of a real-life situation without taking part in it.
		4.2 *'Professional apprenticeship':* supervised participation in professional work.
		4.3 *'Research apprenticeship':* supervised participation in scientific work.
5	*Independent work*	5.1 *Paper:* brief essay based on reading or observation.
		5.2 *Colloquium:* brief oral presentation followed by discussion.
		5.3 *Literature review:* extensive report based on reading.
		5.4 *Research report:* extensive report based on own research, either supervised or not, or independent study of original sources. Technical designs and drawings included.
6	*Tests*	6.1 *Oral examination*
		6.2 *Written examination*: either essay questions or multiple choice questions.
		6.3 *Checking of presence:* judicium is dependent on presence without evaluating performance.

6.4 *Evaluation of process:* observation and evaluation of acquired skill *during* work.

6.5 *Evaluation of product:* evaluation of work product: eg. report, design, etc.

6.6 *No testing.*

Two remarks should be added to this classification. First, quite a number of names of teaching methods are used in common parlance in educational circles, which do not occur above. I think most of these can be translated into one or more of the types mentioned above. Still, in case I have overlooked an important category, there is, of course, no objection to adding categories to the classification.

My second remark concerns the fact that I have added tests as a separate category to a classification of teaching methods. To justify this I would like to point out that whether or not there is a test at the end of a course and of which kind has a marked influence on the preceding teaching situation.

Combining teaching objectives and teaching methods

Let me now try to indicate for each combination of teaching objective and teaching method whether it may be expected to be efficient. By efficient I mean that the method may be expected to lead to the desired goal, while there is no other cheaper method available which may also be expected to lead to the goal. A method is an underinvestment when it is expected not to lead to the goal, and an overinvestment when, although it is expected to lead to the goal, there is an obviously cheaper alternative.

Table 1 summarizes the results of my deliberations on the subject. The table is meant to indicate 'reasonable alternative teaching methods' for every objective. Why I speak of 'reasonable alternatives' I have explained earlier (see "Difference between teaching methods"). In the cells of the table the arguments used are only briefly indicated. Let me therefore list some principles which have guided me in constructing the table.

(a) Knowledge transmission can best be done in written form, because then content and form can be prepared most carefully, and the student can work through the material at his own speed, and, if necessary, repeatedly. Once written down, no teacher is needed to pass the information to the student.

(b) Comprehension, in the sense of virtual or mental manipulation of knowledge, does not automatically arise out of knowledge. Manipulation of acquired knowldge has to be trained explicitly through demonstrations by the teacher and, for complex subject matter, through more or less independent exercises by the students themselves.

(c) Skill in application of knowledge is only acquired through repeated practice by the students.

(d) Students only work for objectives which are tested during the examination. In other words, objectives which are taught, but which the students know will not be tested, will be neglected by students.

(e) Active learning leads to better, more lasting learning results.

(f) Students differ considerably from one another in the speed with which they acquire knowledge and comprenension. Teaching methods which do not tie students to a fixed working rate are to be preferred.

(g) Knowledge of results enhances learning. Teaching methods allowing feedback and correction while learning are therefore to be preferred.

Table 1

	ELEMENT	KNOWLEDGE	COMPREHENSION	APPLICATION
LECTURE	(1.1) systematic lecture	1 - Not efficient. - If used alone underinvestment; in combination with (2.1) or (2.2) overinvestment. - In fact inefficient in any combination.	2 - Not efficient because of underinvestment.	3 - Not efficient: strong underinvestment.
	(1.2) commentarial lecture	4 - By definition in combination with (2.1) or (2.2). Efficient. - With simple subject matter overinvestment possible.	5 - In combination with (2.1) and (2.2) efficient.	6 - If combined solely with (2.1) or (2.2) not efficient because of underinvestment. If combined with (2.1) or (2.2) and (3.1) or (3.2) efficient.
	(1.3) capita selecta	7 - Efficiency doubtful; possibly underinvestment, but sometimes unavoidable; preferably in combination with (2.3).	8 - Same as 7.	9 - Alone not efficient. Possibly efficient in combination with (3.3).
	(1.4) discussion class	10 - By definition combined with (2.1) or (2.2) or (2.3). Not efficient because of overinvestment.	11 - Efficient for reasonably complex subject matter.	12 - Not efficient because of underinvestment.

READING	(2.1) passive study of books	13 - Efficient, except with complex subject matter; Then in combination with (1.2).	14 - Efficient for simple subject matter.	15 - Not efficient because of underinvestment.
	(2.2) active study of books	16 - Efficient. - For complex material combination with (1.2) may be desirable.	17 - Efficient. - For complex material combination with (3.2) may be necessary.	18 - Not efficient. - Efficient if combined with (3.1) or (3.2) or (3.3).
	(2.3) study of literature	19 - Efficient. - Combination with (1.2) or (1.4) will often be desirable.	20 - Same as 19. - For very complex subject matter combination with (3.2) may be desirable.	21 - Not efficient.
EXERCISES	(3.1) practical course	22 - Not efficient because of low rate of transmission.	23 - Not efficient because of overinvestment.	24 - Efficient.
	(3.2) working group	25 - Not efficient because of low rate of transmission.	26 - Efficient if subject matter is complex. - For simple material threatening overinvestment; then (1.4) better.	27 - Efficient. - If combined with (6.3) threatening underinvestment.
	(3.3) project group	28 - Not efficient because of sensitivity to chance fluctuations.	29 - Not efficient because of overinvestment.	30 - Efficient for complex applications. - Sensitive to chance fluctuations.

PRACTICAL EXPERIENCES	(4.1) excursion/ observation	31 - Not efficient.	32 - In some cases efficient.	33 - Not efficient because of underinvestment.
	(4.2) "professional apprenticeship"	34 - Not efficient.	35 - Not efficient because of large overinvestment.	36 - Efficient for complex applications.
	(4.3) "research apprenticeship"	37 - Not efficient.	38 - Not efficient because of large overinvestment.	39 - Efficient for complex applications.
INDEPENDENT WORK	(5.1) paper	40 - Not efficient.	41 - Efficient in combination with (2.3) or (4.1) or (4.2).	42 - If combined with (2.3) sometimes efficient, but threatening underinvestment.
	(5.2) colloquium	43 - Not efficient.	44 - Efficient in combination with (2.3) or (4.1) or (4.2).	45 - Not efficient because of underinvestment.
	(5.3) literature review	46 - Not efficient because of large overinvestment.	47 - By definition combined with (2.3). - Efficient .	48 - Not efficient because of underinvestment.
	(5.4) research report	49 - Not efficient.	50 - Not efficient because of overinvestment.	51 - By definition combined with (4.3). - Efficient.

TESTS	(6.1) oral examination	52 - Not efficient because of sensitivity to chance variations and overinvestment.	53 - Efficient but sensitive to chance fluctuations.	54 - Efficient only for simple applications. - Sensitive to chance fluctuations
	(6.2) written examination	55 - Efficient.	56 - Efficient.	57 - Efficient only for simple applications.
	(6.3) checking of presence	58 - Not efficient.	59 - Efficient in combination with (4.1).	60 - Efficient in combination with (4.2) - in combination with (3.1) or (3.2) or (3.3) or (4.3). Inefficient because of underinvestment.
	(6.4) evaluation of process	61 - Not efficient.	62 - Efficient in combination with (5.2).	63 - Efficient in combination with (3.2) or (3.3) or (4.2).
	(6.5) evaluation of product	64 - Not efficient.	65 - Efficient in combination with (2.3) and (5.1) or (2.3) and (5.3).	66 - Efficient in combination with (3.1) or (4.3) and (5.4).

These are the main principles which have guided me in designing Table 1. The principles are more or less self-evident. Moreover there are many indications in the literature supporting their applicability, (eg. see Bligh, 1972).

Drawing up the table, I have assumed that teachers use the various teaching methods adequately. It is quite possible that a teacher with good reason chooses a teaching method other than the one indicated as being the most efficient, simply because particular methods do not suit him personally. However, the skill of teachers in using various teaching procedures should not be considered as unchangeable; they could learn in this respect.

I would like to point out that, although Table 1 is the result of careful deliberation, it only contains global guidelines. In a particular situation for a particular piece of subject matter one could very well come to different conclusions. The table should be used as a general guideline rather than as a strict recipe.

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Effectiveness of Learning: The Place of Study

Roderick McKay

Introduction

In the light of concern about costs in higher education it is, perhaps, reasonable to speak of the 'efficiency of teaching methods' with terms such as labour input, capital input, resource usage and the production rate of graduates. Such an economic framework has been used, for example, by Layard, (1974), writing on the cost-effectiveness of new media in higher education and is explored elsewhere in this book by Leslie Wagner. Yet the concept of teaching efficiency involves other aspects: student and teacher might be expected to think in terms of gaining understanding, changing attitudes, adjusting to differences in individuals and disciplines - in short, to view efficiency in teaching as leading to effective learning.

For an institution to introduce more effective methods requires, on the one hand, information on the relative advantages and characteristics of the variety of teaching methods, and on the other, acknowledgement and appreciation of its own teaching environment. While information on the characteristics of methods can be sought in the findings of research, local knowledge will follow from the encouragement of institutional self-awareness.

When the University of Canterbury established the Educational Research and Advisory Unit (ERAU) some six years ago to gather background information for academic decisions and, more recently, to offer advice and courses on teaching and examining methods, it was setting up a focus to its continuing efforts to improve the effectiveness of teaching and learning. Investigations so far undertaken by the ERAU have been largely to establish "base-line" data and descriptions of the University's teaching,

and have included studies on assessment procedures, student attainment, characteristics of the student body, and student workload.

How Important is Study?

A considerable proportion of the time that university students spend on their academic work is on study outside the formal classes arranged by lecturers. This extra-formal study, the time students spend on 'private study' when they must establish their own priorities, is used for a variety of purposes. Some of these will follow directly from tasks specified in formal classes, such as completing problem sets and exercises, constructing essays and seminar papers or developing the necessary background for group projects and laboratory work. Other study activities not as directly related to formal teaching will include revision and general preparation of class work, and preparation for assessment; the remainder, if any, of private study time is when students can develop and expand personal interests and read around their subjects.

Both because of the amount of time involved, and the purposes for which study can be used, it would seem proper to consider the effects on study patterns of proposed changes to teaching methods. Will they, for instance, leave less opportunity for study, or place strictures on how study is to be undertaken? And if study patterns are to be largely determined by formal class work, will this limit the student's opportunity to read around his subject and develop an autonomy that will help him adjust beyond university?

Surveys of Student Workload at the University of Canterbury

From a series of workload surveys of undergraduates at the University of Canterbury, we have been able to gain an idea of how much time our students spend on private study, outside formal classes. The surveys were largely concerned with gaining some insight into how students proportioned their time between subjects in our unit (or modular) degree system, on identifying subjects which seemed to be causing students most problems, and gaining some indication of the sorts of difficulties students were experiencing.

Because students were distributed across a diverse range of subject units, often in small classes, and

because we wanted to give each lecturer information about those classes for which he was responsible, we attempted to survey all students in the faculties under study. This differs from the sampling approach taken to establish the United Kingdom student workload data reported in the Hale Report (University Grants Committee, 1964); a sampling approach was also used to investigate the workload of Australian students at Monash University (Clift and Thomas, 1973). In the Canterbury surveys, replies were received from about two thirds of the full time students in the Faculty of Arts (where the survey questionnaire was distributed at lectures, and taken home for completion and posting back), and from over ninety percent of the full time students in the Faculty of Science, where the questionnaire was administered during laboratory classes. In both cases the response was representative of major student groupings.

A further difference between the surveys at Canterbury and those in the UK and Australia referred to above was in the sort of information collected. For both the Hale Report and the Monash survey, students were asked to complete weeklong diaries itemizing the way in which each element of time was spent, whereas, at Canterbury, students were asked to estimate the amount of time they typically spent in various activities. The decision to seek information in this form was made in an attempt to ease the task of respondents and simplify data processing, and was supported by the experiences of the Monash investigators.

A wide variety of factors can impinge on study behaviour (Ryan, 1972) and attempts were made to gauge some of these by including questions on topics such as place of study, patterns of study, subjects giving difficulty, and possible sources of difficulty.

Time Spent on Study

Arts Faculty undergraduates were surveyed in 1973 and those in the Science Faculty in 1974. In completing their returns students reported that they had difficulty in deciding how they proportioned their time between various forms of study. However, it appeared that working on set work was a major study concern. The importance of set work in student study is also indicated by findings from a survey of a sample of science undergraduates at the University of

Sussex, for whom half or more of their study time is on set work (Eraut, 1975). The average times per week spent by University of Canterbury undergraduates in formal classwork and in study are summarized in the table below. For information, figures are also given from the 1964 Hale Report for United Kingdom undergraduates.

	UK Universities		University of Canterbury	
	Arts	Sc	Arts	Sc
Lectures	6.8	8.3	9.7	10.0
Tutorials/Seminars	2.8	1.3	2.3	2.1
Practicals	0.5	7.7	1.6	8.1
Total formal classes	10.1	17.3	13.6	20.2
Private study	25.1	20.4	29.4	21.4
Total (hrs/week)	35.2	37.7	43.0	41.6

Average weekly time in hours spent by undergraduates on academic work.

Sources: UK Universities - Hale Report (UGC, 1964)
University of Canterbury - Student workload surveys (ERAU 1974)

Not surprisingly, formal classwork for Arts students was predominantly in lectures and tutorials/seminars, while Science students were taught mainly in lectures and practical classes. Generally, students spent about 40 hours a week in total on their academic work. This agrees with the order of magnitude suggestions made by writers advising students on study methods - for instance, by Maddox (1964) and Rowntree (1970). The figures found for students in four Arts departments at Monash University (Clift & Thomas, 1973) were higher (weekly, about 10 hours in classes with a total of about 47 hours) but their survey was taken while students were completing assignments, when the workload was thought to be above average.

Although the time spent in formal classes differed between Arts and Science (about 14 and 20 hours a week for Canterbury students) the total study time stayed about the same.

It would seem that, on average, students adjust their time on private study to give them a total of about 40 hours a week on their academic work. This is further suggested from the average times for students in different years of study. Figure 1 illustrates the distribution of total study time between formal classes and private study for first, second and third year Arts and Science undergraduates.

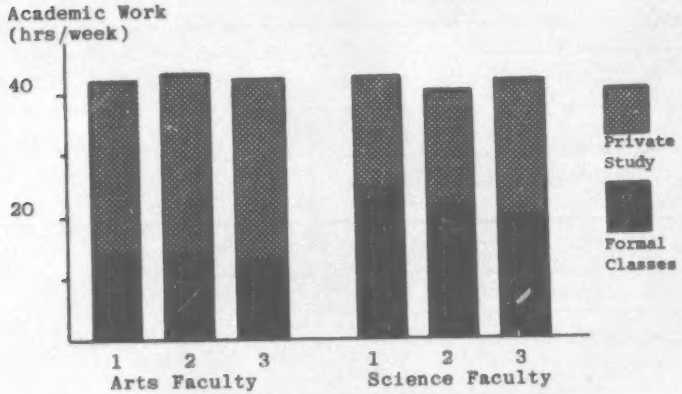

Figure 1 *Average weekly hours spent on academic work reported by Canterbury undergraduates in Arts and Science for first, second and third year of study*

Although the amount of formal classwork generally decreased from the first to the third year, the time spent on private study increased so that the total time spent on academic work remains about the same.

While a consideration of average study times serves to emphasize the importance of private study in the academic life of students, it also hides wide variations in study time between individual students. To encompass the individual times of even two thirds of the Canterbury undergraduates requires a range in total time, centred about the average, similar to the average time spent on private study. This range is

illustrated in Figure 2. (A small part of the variation was due to differences in formal classwork which depend on personal courses of study.)

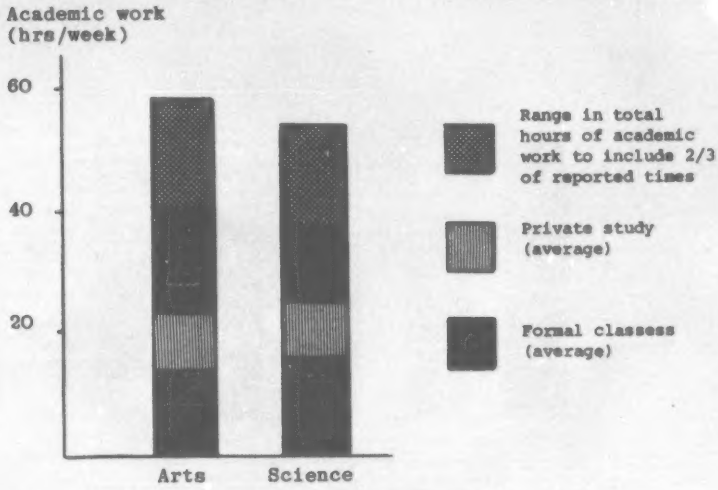

Figure 2 : *Average weekly time spent on academic work, and indication of variation between individual times (a range of 2 standard deviations) reported by Canterbury undergraduates*

While the average total times were similar for the Arts and Science students, the variation in totals was less for those taking science. This can in part be explained by the greater time science students spend in formal classwork, but it also suggests that their private study may be more ordered by requirements to complete problem assignments and prepare for practical classes, with a corresponding reduction in opportunity to follow personal preferences.

Even where students were exposed to the same teaching methods and assignment tasks, as for those taking a particular subject, wide variatons in the time spent on private study existed. Figure 3 illustrates these variations for four popular first year subjects, two in Arts (both with the same teaching format of lectures and small group tutorials) and two in Science

(both taught through lectures and practical classes). The examples have also been chosen to demonstrate the range between comparable subjects in each of the two faculties.

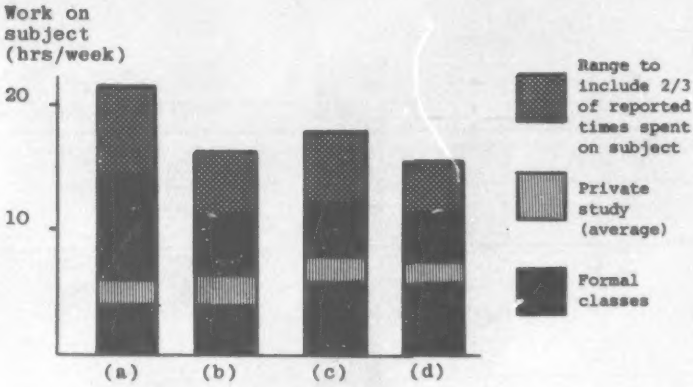

Figure 3 : *Average weekly hours spent on separate subjects, and indication of variation in individual times (a range of 2 standard deviations) for two Arts (a) and (b), and two Science (c) and (d) first year subjects*

For science subjects, with their greater amount of structured formal class time, there was only a small spread in the average total time spent on each subject. As well as a greater range in the average times, the arts subjects also exhibited a greater variation in the time spent on private study. This would seem to support the suggestion that less formal classwork coupled with general study assignments (for example, essays rather than set problems), allow each student greater freedom to develop personal preferences and priorities. Of course, apportionment of study time can be only partly seen in terms of the methods used to teach a subject - pressures from subjects studied concurrently, as well as educational experiences, motives for study, peer attitudes and personal interests will all influence the individuals' study patterns.

It has not been possible to explore rigorously the relationship between hours of study and examination success, as students responding to the questionnaire could remain anonymous if they wished. From a limited inspection, there does not appear to be any strong relation between study and success. However students in Honours classes (to which entry is by invitation) worked for about average times but with a smaller range of individual times than for students in general classes.

Should Study be Managed?

Moves to improve teaching efficiency must also involve a consideration of the effectiveness of learning. Typically, university students spend half or more of their academic time in private study, completing tasks arising from formal classwork, learning and reinforcing ideas, developing interests - from a learning point of view private study is a common teaching method. Perhaps helping students to make 'better' use of their study time, either by improving techniques of private study, or making greater use of teaching methods that incorporate learning opportunities within their structure (such as laboratory work or personalized systems of instruction) could lead to more efficient teaching.

Yet the time that students are able, or prepared, to devote to academic work is limited, and an increase in formally structured work leads to a reduction in the amount of private study. The wide variation that exists might in part be due to 'inefficiencies', but it will also reflect real differences between students, and we might well consider how important a flexible period for self directed study might be for the achievement in some of the objectives in higher education.

Perhaps the heroine in a recent novel, who has had some success in writing poetry, has a message for us when she says - "It took me *years* to learn to sit at my desk for more than two minutes at a time, to put up with solitude and the terror of failure, and the godawful silence and the white paper. And now that I can take it ... now that I can finally do it ... I'm really raring to go." (Erica Jong - "Fear of Flying").

The question remains: to what extent should we try to manage private study?

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Microteaching versus Lectures: A Case Study in Cost-effectiveness

Mantz Yorke

Introduction

This case study in cost-effectiveness arose from a research study (Yorke, 1975) which sought to establish whether microteaching* experience was more successful than a lecture course in developing the teaching ability of first year students in teacher education. Comparisons of microteaching with classroom contact (Allen and Clark, 1967; Kallenbach and Gall, 1969) had suggested that microteaching was the more cost-efficient. However, a scrutiny of these claims shows them to be unsoundly based, for in each study the criteria were the standards reached by the students and the time spent in the training programmes: no attempt was made to quantify the administrative and teaching costs involved.

Outline of the Study

Though it is not the purpose of this paper to give a full account of the experimental procedure, some indication of its scope is essential to set the cost analysis in its context.

Thirty-seven first year students taking a six-hour unit in 'general methodology' were divided randomly into a microteaching group of sixteen and a lecture

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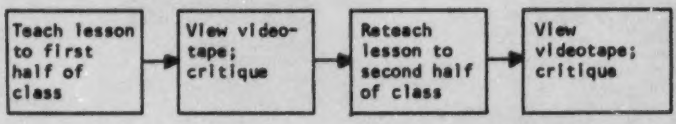
* The original meaning of 'microteaching' derived from the pioneering approach of Stanford University in which teaching encounters were scaled down in all respects (Allen and Ryan, 1969). However, Wragg (1974) suggests a broader use of the term to include situations in which not all of the variables are scaled down, and this paper uses the term in his sense.

group of twenty-one. The two groups came together for the first two (one-hour) lectures and then divided such that each student had a further four hours of class contact. During this latter period the lecture group simply followed a standard lecture course while the micro-teaching group was subdivided so that teams of three or four students taught half-classes of junior pupils according to the schedule:


Teach lesson to first half of class
View video-tape; critique
Reteach lesson to second half of class
View videotape; critique

Since the original group had to be subdivided the author had to retimetable some of the activities in order to be in charge of both the microteaching and lecture groups throughout their respective six-hour courses.

Seven volunteer students from each group subsequently taught a lesson on "Scott of the Antarctic" to groups of approximately ten top-junior pupils in their schools, having been given a common list of specific objectives for the lesson. Their performance was rated by a tutor from the college and was assessed through the pupils' performance on a test devised by the author. No significant difference was found on either measure.

Cost Analysis

The cost analysis presented here is defined in terms of the costs which are relatively easy to identify ('perceived costs'), such as lecturer time and transport. It is difficult to quantify the appropriate contribution of institutional overheads, and these have been omitted at this stage, although an 'order of magnitude' estimation is included later.

The major cost of each course was due to the employment of the lecturer and the rate per hour is calculated on the basis of thirty hours of contractual duty per week for thirty-six weeks. Thus preparation time is costed at the same rate as actual class contact time. Although the first two lectures were common to both groups they are fully costed against each course on the grounds that, had the courses run separately, the costs of delivering the lectures would have appeared twice. The costs of the lecturer's time are given in Table I.

	ACTIVITY	TIME TAKEN	MICROTEACHING TIME (hours)	LECTURE COURSE TIME (hours)
1	Introductory lectures (common)	2x1 hr	2	2
2	Preparation time for (1) (notional)	2x1 hr	2	2
3	Arranging details of microteaching with headmaster and class teacher	4x½ hr	2	
4	Transport time in connection with (3): six one-way journeys	6x1/3h	2	
5	Car travel to collect pupils and later to return to college	8x1/3h	2 2/3	
6	Time spent supervising pupils on bus	8x½ hr	4	
7	Contact time with students during microteaching	4x1½ hr	6	
8	Time spent selecting relevant parts of tapes	4x2 hrs	8	
9	Contact time for the viewing of tapes	4x1 1/4 h	5	
10	Further lectures			4
11	Preparation time for items other than (2) to (8) above (notional)		2	4
		TOTALS:	35 2/3	12
	COST (on the basis of £4.59 per hour):		£163.71	£55.08

Table 1: Comparative Costs of Lecturer's Time for the Microteaching and Lecture Courses

	ITEM	COST OF MICRO-TEACHING COURSE	COST OF LECTURE COURSE
12	Transport: I) hire of coach on 4 afternoons	40.00	
	II) car mileage: 14 journeys of 4 miles (rate 9.2p per mile)	5.15	
13	Technician/cameraman (setting up 1 hr, recording 1½ hr, tidying away ½ hr, all x 4) Rate £1.50 per hr.	18.00	
14	Maintenance (estimated): 2 hours Rate: £3.00 per hr, including wages, materials	6.00	
15	Use of SV 610 videorecorder: (recording 6 hrs; selecting 8 hrs, viewing 5 hrs = 19 hrs) Estimated life 3000 hrs; original cost £400 approx.	2.53	
16	Use of camera: (recording 6 hrs) Estimated life 3000 hrs; original cost £800 approx.	1.60	
17	Use of microphones: (recording 6 hrs) Estimated life 6000 hrs; Original cost (4) = £60 approx.	0.06	
18	Use of monitor: (selecting 8 hrs; viewing 5 hrs = 13 hrs) Estimated life 4500 hrs, Original cost = £120 approx.	0.35	
19	Use of videotape: (average use = 3 runs per tape) Estimated life 100 runs. Original cost (4) = £26	0.78	
20	Ancillary materials, including power for machines - notional	1.00	1.00
	TOTALS:	£ 75.47	£ 1.00

Table II: Costs Other than Lecturer Time for the Microteaching and Lecture Courses

Combining the data from Tables I and II and rounding off to the nearest pound, the costs of the two courses were:

Microteaching course	£239
Lecture course	£ 56

These figures refer to different numbers of students, and it is probably more useful to break down the data to calculate the cost per student, this time allowing the cost of the first two (common) lectures to be shared among all thirty-seven students involved in the study. This is done in Table III.

ITEM	COST £	NUMBER OF STUDENTS	COST PER STUDENT £
I Common lectures, preparation	18.36	37	0.50 (a)
II Microteaching course (excluding common lectures)	220.82	14*	15.77 (b)
III Lecture course (excluding common lectures)	37.72	21	1.80 (c)

* Omitting two students who left before the separate microteaching course began.

Table III: Breakdown of the Cost Data in Terms of Cost per Student

Table III shows that the actual cost per student on the above basis was £16.27 for the microteaching course and £2.30 for the lecture course, the ratio

$\frac{(a + b)}{(a + c)}$ of the costs being 7.07.

Apportionment of institutional overhead costs *pro rata* for the number of students and the duration of the courses gave a cost per student of the order of £8, thus reducing the cost ratio to approximately 2.4.

Thus in the circumstances of this study it proved to be approximately seven times as expensive to run the microteaching course compared with the lecture course in general methodology using the perceived cost per student as the criterion, though the ratio

was reduced to the order of 2.4 when institutional overhead costs were included. However, the possibility of economy of scale must be borne in mind, and it is necessary to consider the marginal costs of each course.

Marginal Costs

The marginal costs* of the lecture course would be approximately zero since it would have been possible to accommodate many more students within a similar lecture format. Large increases in student numbers would necessitate some change in style of lecture but this would be unlikely to have any major effect on costs.

The marginal costs of the microteaching course vary according to the number of students already present. Assuming that two groups of four students can be accommodated in an afternoon, it follows that the marginal costs of an extra student above the fourteen taught in this manner are zero: a group of three students is simply increased to four, though this would entail a slight reduction in the average teaching time per student within a lesson of forty minutes. On increasing from sixteen to seventeen students in the course, however, reorganisation is necessary into at least five groups if the group maximum is set at four students. This necessitates the use of at least part of an additional afternoon with extra costs of transporting pupils, lecturer time and television operation. Of these increases the last two have been calculated on a pro rata basis, but the first represents a 'quantum jump' in cost. This new level of cost would then remain effectively constant up to twenty students - slight increases in classroom materials might be necessary - but twenty-one students would have to be distributed into six groups. The extra costs here would be not so large because the pupils would already be in the college and the television equipment would be set up: lecture-costs and running costs of the television equipment would be the only costs to rise.

Thus the marginal costs of the microteaching programme are not a simple linear function of the number of students. The perceived costs of the microteaching programme, together with projections for up to thirty-

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* Marginal costs are taken as the costs incurred in teaching one extra student on a course.

two students (assuming a similar organisational structure as in this study) are given in Table IV and Figure I: the comparison between the two courses on the basis of perceived costs per student, is represented graphically in Figure II.

NUMBER IN MICROTEACHING TREATMENT	TOTAL PERCEIVED COST £	INCREASE IN COSTS FROM A BASELINE OF £239 £
13 to 16	239	0
17 to 20	278	39
21 to 24	288	49
25 to 28	327	88
29 to 32	337	98

Table IV: The Increase in Perceived Cost of Providing Microteaching for Different Numbers of Students

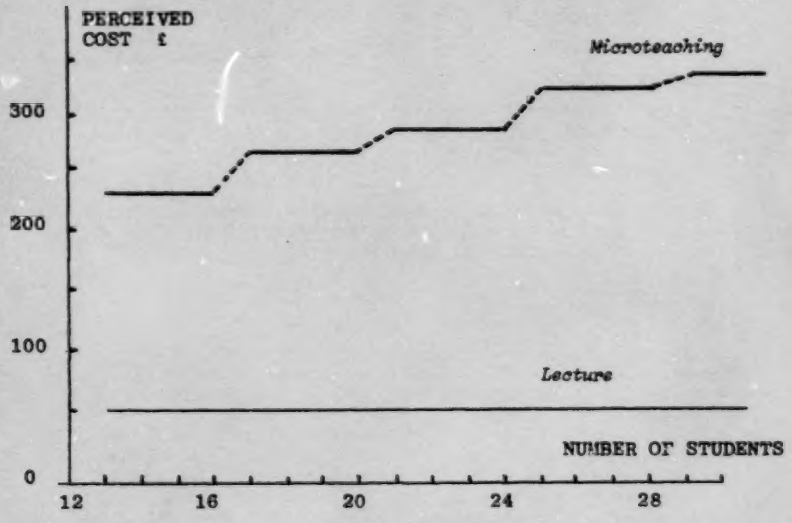

Figure I: The Relationship Between Perceived Cost and Number of Students for the Microteaching and Lecture Courses

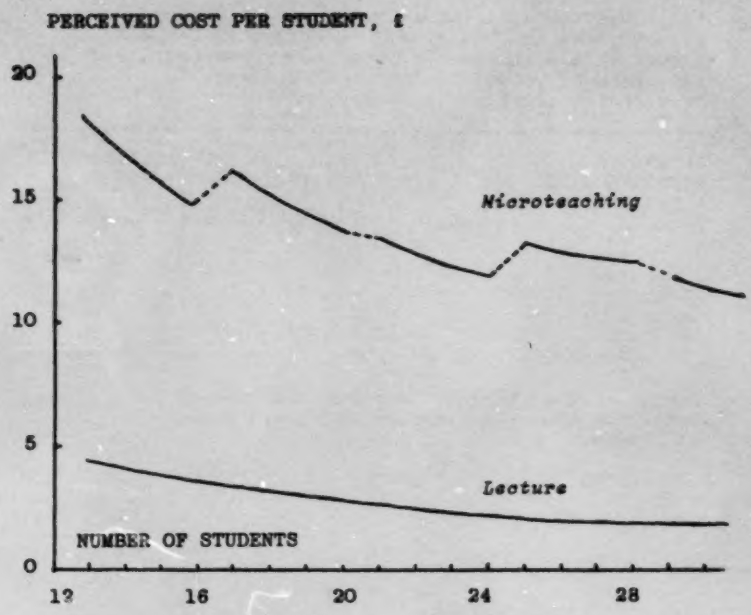

Figure II: The Relationship Between Perceived Cost per Student and Number of Students for the Microteaching and Lecture Courses

Some care is necessary in interpreting the data, however they are presented. A cursory glance at Figure II might suggest that the difference between the perceived costs of the two courses narrows as the numbers get larger: in fact, the ratio of the microteaching costs is the lecture costs increases in a stepwise fashion similar in form to the costs of the microteaching course in Figure I - this is not surprising, because the denominator remains constant whilst the numerator increases in the stepwise manner indicated. With fourteen students in each group the ratio is 4.27, whilst for thirty-two

students the ratio has risen to 6.02: it must be remembered that the ratio of 7.07 quoted earlier referred to groups of different sizes.

Thus it can be seen that the microteaching course becomes relatively more expensive with the extent of use when the criterion is the perceived cost. However, when an allowance is made for institutional overheads the cost ratio *declines* slightly with increasing numbers, from approximately 2.1 with fourteen students to approximately 1.9 with thirty-two students.

However one costs this particular approach to microteaching it is more expensive than the corresponding lecture course, and judgments of its relative effectiveness and value will have to take these economic considerations into account.

Discussion

In discussing costs it is necessary to consider what is being costed, to whom the costs are debited, and the context of the costing exercise. Taking the last point first, the purpose of the study was to attempt a comparative evaluation of the effects of two courses on the acquisition of teaching competence by students. Therefore the prime criterion must be the degree of success when teaching in a classroom: this could be assumed to have some ultimate influence on society. However the success of a section of a course must be related to its broader context - it would be hard to justify the introduction of an 'expensive' but successful section of a course if it were to have a deleterious effect on other sections, in other courses or on the working conditions of the staff. Thus a judgment as to whether a course is worthy of introduction will require the balancing of a number of possibly conflicting factors: the costs outlined above suggest that the inclusion of microteaching in a course on teacher education should be subjected to close scrutiny.

There are certain costs incurred merely by running the course in an institution. For example, the capital costs of the building and recurrent expenditure such as heating, lighting, administration and ancillary workers all contribute in some measure to a course. Since the two courses could be expected to draw on these to approximately the same extent (and also because they would be difficult to identify

accurately) it was decided not to include them in most of the cost analysis, though it is clear that their inclusion lessens the cost ratio of the two courses. A strict analysis would need to include an appropriate proportion of the costs of the administration beyond the confines of the institution as well. However, the costs analysed in this study were confined to those rather more easily seen in the context of the institutional budget; namely, the costs of staffing the courses, the costs of equipment and materials used, and other relevant costs such as transport.

Even when the costs are relatively narrowly defined, there are still difficulties. The costs of a lecturer's knowledge and experience are not easy to assess, nor are those due to the books and periodicals studied over a period of time - a point germane to this study where the author had spent considerable time perusing the literature on microteaching. Even the basis of costing an hour of lecturer time is debatable: Selby Smith (1970) divides lecturer salary (only) by the number of *class contact* hours in a year to obtain an hourly rate, but this overlooks the contractual obligation to be working on the premises for a considerably greater number of hours each week, as well as overlooking the costs to the employer of superannuation and National Insurance.

In the author's case class contact hours were eighteen but contractual hours were thirty. Since the difference of twelve hours is supposed to be for preparation and administration it would seem more valid to include this factor in the determination of hourly rate. The author's hourly rate of £4.59 was calculated on this assumption and also included 9.4 per cent and 8.5 per cent of annual salary for superannuation and National Insurance respectively.

Other costs exist which were not investigated during the course of this study. The student input time was not recorded, and this could have been markedly different for the two groups because one group was required to prepare to teach and the other was not. Also it is difficult to assess the cost or benefit to the pupils brought into the college for the micro-teaching since it would require a judgment of whether the stimulation of a new environment plus the learning therein was of greater value to them than their regular afternoon in the classroom.

Although the data indicate that the microteaching course is considerably more expensive for no

significant difference in measured outcome it is fair to point out that this study did not attempt to assess outcomes of a longer-term nature, such as attitudes to teaching or the degree of insight into the teaching learning process possessed by the students. A different style of study would be needed to investigate outcomes of this nature - perhaps based on Parlett's (1972) 'social anthropology' paradigm.

To the student, microteaching is active and practical whereas other approaches are often passive and merely descriptive, and it may be that research comparing microteaching with other teaching approaches is, in the final analysis, misconceived. Perhaps the proper comparison should be with teaching practice which, in the light of recent salary awards and of the sharp rise in fuel costs, must be a heavy financial burden to a college. There are few data available on the costs of teaching practice but it might be a reasonable assumption that they would be higher on a per-student basis than a microteaching course of almost any type. McAleese (1973) has already reported that the Ministry of Education in Nothern Ireland equates one microteaching session at the New University of Ulster to one day spent in classroom observation. The substitution of part of the teaching practice requirements by microteaching would make a very worthwhile study which might suggest whether this further step were soundly based. If it could be demonstrated that microteaching was, at least, no less successful than teaching practice at a fraction of the cost, then its justification would be secure.

Conclusion

Although microteaching was found to be more expensive and no more effective than a lecture course it is not justifiable to draw general conclusions from this particular case study which focused on some observable short-term effects of one particular approach to microteaching, possibly atypical because of its phenomenological, rather than behavioural, base. Rather, this study might serve to stimulate critical appraisals of the costs of educational practices and through these lead to a more efficient use of available resources.

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The Computer in Practice as Aid to the Efficiency and Assessment of Learning

F T C Harris

Synopsis

The Department of Research and Services in Education works in association with the Department of Computer Services of the Middlesex Hospital Medical School (MHMS) and carries out research into educational data obtained through the services that it provides to departments in medical schools and others in the UK and elsewhere; and into data obtained by collaboration with postgraduate and other medical organisations. It also carries out work in collaboration where data is collected with a specific research topic in view. At present we have the ability to provide a wider range of computer aided educational services than any other Western European group, but we also differ from such groups in that our techniques emphasise storing identifiable data for research and also for our research into the data that we collect. We normally provide routine services to about 100 departments and individuals, processing up to 30,000 candidate assessments annually. The number of organisations with whom we have, or are collaborating currently totals about 160. Well over half of the undergraduate medical students in the UK use our batch processed computer education aids at some time during their undergraduate careers, and a large proportion of them throughout those careers.

We have developed a full range of multiple choice question based assessment aids involving both batch processing and interactive use of computers by students in student exercises. We can score MCQ using any valid scoring strategy, reorganise such papers into any desired number on output, score candidate answers against computer disk held files of correct answers and so on. We have computer aided techniques for storing and retrieving multiple

choice questions (these automated files now hold probably the largest number of medical MCQ available anywhere - about 22,000), we can list MCQ from the computer ready for printing by offset lithography. We have developed techniques for printing text onto microfilm. We normally use computer board funded computers in London University (CDC and IBM) and communicate with these using either the batch-processed terminal (PDP 11) of MHMS, by direct physical collection or delivery or by use of interactive teletypes. The PDP 11 terminal provides us with the facility of routing output from our scoring programs, run on the UCL IBM computer, to any compatible computer installation in the UK. In particular this facility will become routine with all of the London Medical Schools soon. But as at the moment our data collection depends primarily on an in-house machine, cards have to be sent to us for input, and for archiving on our data-tapes. We are currently developing a technique for inputting cards by means of a readily available and moderately cheap optical card reader. However, we find that for most purposes the postal services or variants such as Data Post, London University Post, Red Star or Securicor are adequate. We are only partially funded by UGC and Computer Board, so are having to find technical staff salaries etc elsewhere. Consequently, we have to charge for our services.

Computer based learning has three main applications: simulation, with which I am not here concerned, learning by students and the evaluation of that learning. Ours is the only department in the European Economic Community which concerns itself with both the last aspects of computer based learning on a national and international scale.

The Department of Research and Services in Education (DRSE) of the Middlesex Hospital Medical School develops and services computer based educational and assessment aids, making them available to any collaborator satisfying certain conditions. This puts us in a position in which we are able to compare and evaluate the techniques that we have developed within our area of expertise and from a position of neutrality, but of some confidence in that they are certainly popular and sought after by the many departments, both university and otherwise, that work with us, and pay for the work that we carry out on their behalf.

Within the area of computer based learning we have

two main vehicles in one of which the student works from a teletype getting his information back immediately - or fairly immediately, depending on response time. In the other the student is one of a batch answering questions by responding with a mark signalling 'yes' if he agrees, or no mark; and using a special form designed to be read both by himself and by a machine.

The questions that we can ask ourselves are such as: What are the advantages of a batch system over comparable books? Are there advantages in a comparable interactive system? Why are both systems so popular with staff, even though they may have a level of computer sophistication appropriate to the use of interactive terminals, and sufficient determination to cope with their apparent whims?

Probably the best way of answering these questions is to outline what it is that we do for collaborators and leave the reader to formulate his own answers to the questions in the light of his own experience or expectations.

Over the 12 months ending 31st March 1976, our small staff of two full time academic staff with two half-time data-processing assistants prepared 4 papers for publication, 15 reports evaluating learning situations and processed about 15 thousand students' attempts to satisfy quizzes, tests and examinations set by their mentors. These attempts came to us in about 250 batches and the time devoted to setting up, processing and administering these involved about 1/4 of our available staff time giving a ratio of that time to student response time close to 0.05. For the departments originating such batches the corresponding time ratio (OTR) ranges from 0.5 to 0.005 dependent upon the use made of our services and also other factors. Later I shall review these services to give you a better idea of how computer based learning techniques can save staff time. The great advantage of a batch-processing system for students is that they get a series of dead-lines to which to work. Their motivation often depends on their commitment to the dead-line and this commitment is greatly increased if the dead-line ranks as an examination. Examinations are the most useful and the most efficient form of a learning stimulus yet devised.

Batch Processing - Data Collection

The collection of accurate data from large numbers of individuals presents particular problems necessitating careful design of data-collection documents that are suitable for use in a carefully thought-out procedure. Data collection has been designed to be simple, rapid and cheap. Four methods are in use, and others are under review. Our major techniques involve cards rather than sheets, and we foresee very good technical reasons for continuing this policy into the future.

As well as the technical reasons mentioned, cards are cheap and convenient to post, convenient in the examination room, convenient to layout and check, convenient for the student to carry (c.f. SLAM below) and convenient to access on the few occasions that we have telephone queries about individuals. All techniques of data collection include full linkage between the candidate and the data finally analysed. Linkage is established by the use of candidate codes, card numbers (or sheet numbers in the cases of LECTOR and UDT), master codes (used to link together all the candidates within an examination), and ultimately by the candidate's signature on the original document.

Linkage for cards is facilitated by precoding all cards used directly by the candidates (we can use our utility (MSPP)), and by providing each candidate with a card with his name on it. Code numbers are easily forgotten, or can easily be mistranscribed. Candidates are more likely to recall their names! It is difficult to provide equally foolproof linkage for a sheet/document system. The name cards can have other uses (in communication), and we also have programs that enable us to use these name cards in setting up student files for servicing the interactive program. Such inter-digitation is a feature of all of our many programs. The name card is a most important component of our Research File Archive. Our data collection techniques and documents are:

a) Any data can be manually keypunched. This is more costly than our other methods but is adaptable to many situations. Suitable data formats are essential for effective transcription of such data and any of our collaborators considering such techniques must consult us before collecting such data if we are to process it.

b) Mark Sense cards are the major means of collecting

our examination data and several formats of such cards are available through us. Our 'Standard' mark-sense cards are double sided, and permit the answers to 20 questions, or less, to be recorded on each side. 'Pair' cards enable data to be collected from questions in which both 'true' and 'false' answers must be indicated. 'Triple' cards are used for the collection of psychological data, but can be used for other purposes also.

c) Optical mark-read documents LECTOR are non-standard, but are available although not fully supported. Specially printed documents are used directly by the candidates to record their answers. The documents are converted to paper-tape records, which are read by a special utility program, which converts the data into mark-sense card format for use by the scoring program.

d) Optical mark-read documents (Universal Documents Transport, Senate House, University of London) are used by the central University of London scoring services. Users of that service can elect to have their data archived and/or scored through our scoring programs. The magnetic tape which is held as a temporary record after processing of the answer documents on the Senate House ICL 1900 computer are read by one of our utility programs (UOFL) and are translated into a form suitable for entry to the scoring system. Such data is then included in the routine monthly update of our archival data tapes.

e) Optical card reading techniques are under development in association with the MHMS Department of Community Medicine.

Batch Processing Programs for Objective Assessment

A number of major programs have been written to assist in group assessment, data collection, scoring, and analysis of objective tests.

Class, Course and Postgraduate Examinations

The program for this is SCORE (current version SCORE9); it is designed to fulfil the following requirements:

a) To embrace any reasonable marking strategy.

b) To provide the examiner/teacher with a clear summary of overall results from properly checked data.

c) To give information on the performance of candidates/students with respect to their mistakes as well as their correct judgements.

d) To analyse the examination as a whole, for its reliability in whole and in part.

e) To enable the examiner/teacher to assess the suitability of each question and its constituent parts.

f) To provide summary results of the question analysis for storage in the question bank.

g) To provide a Computer Listing of the statistical analysis of the examination and questions that can be conveniently and economically reproduced in A4 sized booklets for distribution to examiners.

h) To control the use of resources by noting the work done, and by providing a charging basis to users.

i) To route linked candidate result records to any computer readable storage medium in preparation for research on student/candidate performance.

Student Personal Assessment SLAM

Score incorporates features called MINISCORE, which enable the student to obtain personalised results. Such output includes all the student's scores, and may optionally include the student's pattern of selections to the questions in the test administered. Summary information is available to the teacher, and all the other facilities of SCORE9 can be operated at the same time, including full examination and question analysis. These procedures have been incorporated into a protocol which we call SLAM (self learning assessment modules), and which use multiple choice questions; these have notes and references for each question and so provide a teaching as well as an assessment technique comparable to one of the uses of program TESTER but having a different role.

Psychological Assessment

We have automated a procedure PERSON for scoring the well-established personality assessment questionnaire, THE 16 PF TEST (Professor Raymond Catell). This permits the comparison of groups on non-subject matter based measures. It is particularly simple to

administer, but is restricted, for copyright reasons, to our collaborative projects.

Subjective Assessment; 'Traditional' Examining and Teaching

A suite of programs called ASSESS are under long term development to process data collection (using 'Assess' cards) for subjective examinations. These procedures do not of course provide actual scoring of scripts, but they are used to recover the data for routine analyses. The difficulties of data collection have been the most potent factors restricting analysis of subjective examinations on a routine basis in the past. We are developing ideas to support Assess in student self-teaching.

Student Communication

We have programs available LETR which enable us to use candidate name cards, prepared for examination scoring runs to be batch processed, and to use these directly to prepare letters or notices that can be sent to students through the University or internal college post.

Questionnaires and Surveys

We have available a small series of programs SUMMATE designed to facilitate the handling of routine questionnaires, such as might be used to obtain general course feedback. These use mark-sense cards to collect the data.

Archiving Test Data

Amongst our utility programs is TRNF used with a defined procedure for the monthly updating of magnetic tapes with SCORE9 input data; thus we have available for our own research every MCQ input item ever processed by us (with two exceptions). This amounts to 2229 examinations to 31.1.76 and because of our method of record linkage is in the form of cohorts of data for many medical schools (with respect to medical education we are in a position analogous to that of astronomers to the solar system).

Educational Material

Question Banking, Examination Paper Preparation

Most question papers used through our SCORE system are

retained by us, and a large proportion of the questions in them have been transcribed to our computer readable files with their associated statistics of performance. These files now hold around 22,000 MCQ and can be accessed in many different ways by our automated question banking and retrieval program QBANK. QBANK interfaces with the SCORE programs, and also with local banks held by, or which we prepare for, our collaborators. All questions are regarded by us as the property of the originators, and are not made available to or exchanged with others without permission. Not only does the bank provide a much used service facility but additionally a major research file. Part of the system enables teachers to study the past performance of questions. As each classificatory category becomes filled we print all 999 questions for that category on microfilm.

Computer-Aided Master Copies for Printing

This facility is not generally available due to shortage of staff time. QBANK also produces text output from the bank in a form for processing by another of our utility programs LIST and procedures whereby we can produce master copies of question papers from which bulk printing can be carried out from microfilm or by offset lithography. This saves editing and secretarial time, but if an adequately high standard of reproduction is to be reached it is necessary to use commercial printing firms. Whilst we can arrange for this we prefer users to make their own arrangements, but we will gladly advise on firms providing suitable standards of printing. Alternatively and for London University only, Senate House printing is available. (Using our utility SDTR all such master copies are Archived on our Questions and Bulletins Tapes so that we are able to easily re-create fully edited master copies of tried and standardised papers suitable for particular levels of medical teaching.)

Security and Confidentiality

All results are held by us in total confidence. Results on the performance of individual candidates will never be available from us, but only through the departments, boards of studies etc with whom we work. The results of research on the performance of GROUPS are published in collaboration with or with the approval of those with whom we collaborate, but any processing of data is always carried out on the

understanding that the data is available for research by us.

Similarly, users depositing questions in the question bank retain full control over them. Any person wishing to get access to questions in a particular subject is either put in touch with a user in the subject, or we get agreement for release from the owner. Some owners have given us permission to use our own judgement in granting such permission.

Because our archival files are so encoded that data can only be retrieved from them by running the tapes through our scoring programs our policy is that security will not permit us to supply copies of the programs to others, even if all technical problems of transfer and program maintenance could be overcome.

Research and Analysis

We use as our data source the data archived by our routine data collection scoring procedures and these are sufficiently flexible for us to incorporate a very wide range of examination, questionnaire and survey analysis. We have access to the standard statistical packages eg. SPSS, BMD, SSP, etc; we have also developed special purpose statistical packages of our own to assist in this work. We have published some 30 papers to date entailing studies on groups, cohorts, teaching and examining methods and techniques.

Technical and Programming Development

We follow a policy of continuous development and improvement; where collaborators have special requirements we are happy to discuss them in the expectation that a working compromise can be found between such need and our existing or planned procedures but we cannot undertake special programming for others.

Bulletin Services

As with any services department, we must maintain full contact with users to inform them of the available services. This bulletin is one of a complete range of bulletins available through us. We also produce interim research reports. To date about 70 have been written by us; some are confidential and restricted.

Other Data Collection and Analysis

Some people have found that our mark-sense cards can be readily adapted to data collection for their own special projects. Where this is the case, we can supply cards and provide advice on their use and on the analysis of data so gleaned.

Objective Assessment Based on Multiple Choice Questions

Interactive Programs

We have developed two programs providing interactive facilities for students who may thus directly interact with the computer. The programs, one for student use, TESTER, and the other for servicing the student program, UPDATE, run on CDC computers under the Kroncs Operating System. They provide a wide range of facilities and have to date been used for pre-finals revision. They are very popular. They have a wider range of applications (including free text entry to answers by the student, and structured course work) and these will be implemented as collaborators come forward wishing to use them. The revision material used so far has either been drawn from our question bank, with agreement of the owners of the questions, or has been specifically written for use on the system. So far the program has been used by students in two medical schools.

Costs

Over the 12 months ending 29th February 1976, about 100 of our students have also used interactive computing facilities developed by DRSE (use by other medical schools is here ignored). For this use the originating department time ration (OTR above) is about 0.13, but our expectation is that within medical schools OTR will increase, that is to say be worse, as the denominator increases. If we concentrate on the use of both systems (interactive and batch) then the student response time for batch mainly comes at the end of a period of self- or organised student instruction - first the student does his work, then he marks his cards. On the other hand the response time is intermingled with instruction - it is part of the use of the procedure - in an interactive system. Thus the inclusion of quizz-orientated instruction improves OTR for batch to at least 0.05 in the worst case, but only improves interactive OTR to about 0.06 in the best case

although the use of the interactive system in a Keller approach might bring a further improvement in OTR.

Both batch and interactive systems are popular, batch giving varied and sensitive information on quizz and student performance whereas whilst interactive is less sensitive and varied it does usually give more immediate response. It is incidentally much more troublesome to the user and this cuts off many students who do not have the flair of knowledge to cope with machines. The popularity of batch is underlain by the willingness of departments to pay service charges of about 20p per student response hour. So far departments have not been faced with interactive charges when they could find the cost in telephone bills alone to be 53p per student interactive hour and rising to over 97p (average student use for interactive learning in our experience is about 10 hours in a two week period and with a daily regime for the entire student batch covering the 11 hours from 10.00 to 22.00 - the central computer on which we carry out this work normally closes down at lunch time!)

Even with the maximum of our services (when OTR becomes about 0.005) the batch system service charge does not exceed 50p per student response hour. But having said all this it must be borne in mind that the cost of a Batch system is about the cost of a comparably drafted book when compared on an hourly basis. But of course the book contributes nothing to the objective analysis of text nor does it aid the evaluation of its own effectiveness, all of which is an add on cost whereas the cost of data-collection is covered by the batch automated system.

Because only part of our small staff and equipment is directly supported by UGC and related funds, we have to make small charges for our services to fund part-time technical staff and to purchase some of our equipment. We have been fortunate in receiving grants through the generosity of the Association of University Teachers, the Drapers Company, the Nuffield Foundation, and the Astor Foundation. We have also received some support from the MHMS, and separately from some of its departments. While this has covered some of the cost of this work, the bulk of the cost has to fall on the users of the system, and we make carefully assessed charges for all our service work, involving a standing charge of £ 10.00

covering a set number of candidates and questions; numbers exceeding those covered by the standing charge are charged pro rata and other charges, e.g. for question preparation and printing etc, are also made. As an example, charges for multiple choice work are typically 15p per candidate assessed. All the charges are less than any comparable way of undertaking this type of work.

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The rationale for our procedures may be found in the following publications, amongst others:

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Computer Assisted Learning: An Efficient Technique or An Extravagant Diversion?

J R Hartley

Introduction

Using the electronic computer as a direct teaching instrument is not a technique which readily comes to mind when debating efficiency in Education. There are obvious difficulties in communication when using a terminal, particularly in the limited methods by which the user can respond (eg. by typing) to material which has been displayed. Further, the expense of computing equipment, and the costs of developing material and a highly interactive system to manage the on-line instruction, appear to be serious disadvantages to adopting Computer Assisted Learning (CAL) as an economic technique well integrated within the day-to-day teaching of departments. On the other hand, there has been much activity during the last ten years. Most of the projects in CAL have been sited in the USA, but there are other large scale developments. For example, the National Research Council of Canada is sponsoring and coordinating projects at several universities, and similar developments have taken place in Germany. In 1972 the British Government launched a £2-million five-year programme of work. Several large CAL projects in Higher Education were set up in the Physical, Medical and Social Sciences, and a mid-term report has recently been published (Hooper , 1975). So progress has been made, and there has been sufficient promise to encourage continued investment at institutional and national levels.

Although many of us feel overwhelmed in trying to analyse the term 'efficient' when applied to such a complex and loosely organised system as Education, we are all aware, in the small scale, of difficulties which we encounter in teaching classes of students and which, if solved, would increase the efficiency

of the teaching/learning process. The following section tries to summarise some experience of CAL in ways which indicate those attributes which should be useful in overcoming well-known teaching difficulties. This is followed by a brief account, which includes specific illustrations and evaluation data, of a project which has used the computer to teach Applied Statistics to a large number of Social Science students over a period of three years.

THE TEACHING FUNCTIONS OF THE COMPUTER

Tutorial Programs

Any lecturer is aware of the difficulties which face him when he has to teach relatively large groups of students, for good opportunities of giving individual feedback and correcting difficulties are extremely limited. This lack of adequate feedback is likely to create problems, especially in the subject areas where concepts are technical and require a precise understanding, and where the relations between them are often expressed in formal ways. Further, if large sections of the subject are hierarchically arranged, a patchy understanding of elementary concepts is likely to lead to recurrent problems with the more complex principles.

It is the opportunities for providing feedback and for allowing some individualisation in teaching decisions which is making the ideas of CAL attractive to some teachers - and research gives some support for their optimism. Anderson, Kuhlhavy and Andre (1971) carried out experiments using different feedback schedules with a computer administered program in electro-cardiography. The results show several benefits which arise from a computer administration. First, it imposes a degree of control in that feedback is not available until after the student responds (cf. textbooks and programmed texts where the instruction can be short-circuited and the answers looked at prematurely). Second, the experiment suggested that the main funciton of feedback is not to strengthen or reinforce correct responses, but to locate errors and provide information so that the learner can put them right. A corollary is that tutorial programs should not necessarily be small step, but have tasks large enough to expose the student's individual misunderstandings and provide feedback to correct them. Whether these messages should be merely printed or

given in an 'active' mode which requires a response is a decision which research has shown should depend on the competence of the learner (Tait et al, 1973). Another important variable is the amount of direction which should be imposed on the student's learning by the program. At one extreme the routing can be made entirely dependent on individual performance measures; or the student may be given freedom to choose the content sequence and the type of teaching which suits him. Some studies (eg. Abbat , 1972) point to the advantages of adaptive decision rules in which more responsibility is given to the student to make these decisions as he becomes more competent in the subject area.

Thus there are arguments and evidence for CAL programs which exercise control over content, feedback and the amount of direction which is given to the student. Further, such tutorial programs also collect the performance data which are used in decision making and which can point out particular weaknesses and provide guidance on further work. These data are useful to the teacher for they indicate students who are having problems, and those areas of the course which the class as a whole are finding difficult. Any glance at the indexes of CAL applications will show that there have been many developments which have sought to exploit these advantages through the tutoring role of the computer.

Simulation

Typically, tutorial programs are written using an Author Language and are stored in the computer. To write this material, experienced teachers stipulate their objectives, undertake task analyses, sequence the content, set out the responses which are anticipated at each point in the program and the routing decisions which are then to be carried out. The fact that the programmed material has to be specified in these detailed and particular ways implies that the student can only have limited control over the teaching dialogue. In general, he cannot propose his own methods of solution, or comment on the materials, or ask for explanations, or pose supplementary questions unless they have been anticipated by the course author. Thus the teaching modes, though useful, are limited.

For the illustration of concepts, different types of programs are required in which the student has some ability to discover for himself the underlying

relations. Simulation exercises have been widely used in the Sciences to fulfil this need, for many of the concepts are not only difficult to illustrate, but the relations between them are expressed in formal and symbolic terms. The idea is that computer programs should provide a working model of the scientific system. In fact, it is the formal representation of the system (ie. a set of equations, or a quantitative data base that can be sampled) which is embodied in the programs. Usually the student cannot edit or amend the program itself, but he can manipulate the input values and observe the effects on the output displays. For example, ROOS (1973) has a series of programs which simulate the human menstrual cycle. The output shows the time of ovulation and the time and duration of menstruation. The user can substitute hormone treatments and observe the suppression effects on ovulation, uterine development and/or menstruation. Hormone concentrations and cyclical events are related by a series of simultaneous equations, and randomisation ensures that each cycle is uniquely determined. Many other specialised simulation programs have been written and described (see, for example, the program listings of the UK National Development Projects in Engineering Science, Computational Physics and Undergraduate Science (1975)).

These examples show some of the advantages which justify simulation as a teaching device. For example, the learner can operate with a simpler system than he would encounter in reality. Again, knowledge of results is given without detrimental consequences. After typing input values, the student can see their effects on the outputs which are displayed and so explore the consequences of his choices. He has control over time and a relatively unlimited number of replications which help him to develop predictive performances of the system. However there are difficulties. Building simulators to serve as teaching devices is not an easy task. Any help in selecting inputs or teaching about the parameters or the evaluation of results is usually left to the student, or has to be supplied outside the program. Typically simulators keep no record of the learner's protocol and so are not able to give him guidance during subsequent runs of the program.

Problem Solving

While simulation programs can provide illustrations which it is difficult to give by any other means, and

although teaching dialogue can enable the learner to perceive salient points about input and output values, they rarely give him insights into the structure of the program. The student cannot amend the program, neither is he involved in its design. In many situations it is not appropriate that he should be, and even where there are potential benefits in this activity, a language has to be devised which is easy to learn, provides immediate feedback on errors, has a clear structure which matches that of the subject, and permits sophisticated programs to be built up from simple procedures.

Several workers have attempted to devise such languages so that the student can write his solution to problems in ways which provide insights in the underlying subject matter. Probably the best known of these is the language LOGO which can be learnt by school children, and which has suggested interesting developments in the curriculum and methods of teaching Mathematics (Papert and Solomon, 1972). For example, the pupil might devise programs which draw geometric shapes on a crt terminal. The simplest procedure is to instruct the cursor to move forward *n* steps, rotate through an angle and repeat these instructions recursively. By labelling the parameters, and altering the values, the pupil can study the shapes produced. Simple additions of an extra step-length command will cause spiralling, putting in tests to control the sequence of commands will allow the shapes to "roll" along, or round themselves. Such programs can be extended and can be generalised. It is maintained that the exercises are stimulating, can develop the children's notions of the properties of shapes and symmetry, and allow them to do this in their own ways. Papert has written several reports on his experiences of teaching children by these methods (Papert, 1971a, 1971b). At the university level, Brown and Rubenstein (1973) have used the language with Psychology undergraduates. The emphasis there was not on Mathematics, but on topics in Linguistics and Grammars which were related to their curriculum.

The second approach to problem-solving has been to allow simulation programs to be called from tutoring programs which are written in an Author Language. Thus dialogue can be incorporated with simulation exercises and more help and advice given to the student on-line when it is necessary. For example, Bork (1975) has written an elementary program, Luna,

which is based on graphical input using a built-in pointing device in the terminal. The learner moves between alpha-numeric dialogue and graphic information as he learns about the positions of the sun, earth and moon. To study eclipses he can position the sun at any point in the system. Depending on his choice, the teaching dialogue either points out his errors directly, or shows the light rays and the eclipse patterns which would be produced. Another application has been developed at the University of Leeds (Ayscough, 1973): the main aim is to help the students to plan laboratory experiments. In the traditional course the laboratory manual gives detailed guidance on the conduct of experiments, and the student plays little part in their design. Therefore the functions of the computer based materials are two-fold. First, to specify the problem and to provide a method of self-testing and remedial teaching of the background theory. Second - and this is the major aim - to give the student opportunities to make decisions about the experiment. The dialogue requires him to consider the choice of apparatus, methods of measurements, and the way the data will be collected and processed. For certain types of experiment where the collection of data is unnecessarily time-consuming or experimentally inaccessible, the programs themselves will simulate and provide data on proper instructions from the student.

A DEVELOPMENT PROJECT IN APPLIED STATISTICS

Typically the objectives of any large development project will require all these types of applications of the computer, and this section outlines the experience of using these techniques in teaching Applied Statistics. In the Social Sciences statistics and quantitative methods are becoming increasingly important, and they are taught in many different subject areas which place varying emphases on statistical theory and on practical applications. Typically, student numbers are large and there are wide variations in mathematical experience and in the students' motivation towards the subject. It is within this framework that the teaching roles of the computer and the materials and programs have been developed.

The project was set up by the National Development Programme in CAL in 1973 with ten teaching departments

from the Universities of Leeds and Bradford and the Leeds Polytechnic taking part in the work. Twenty-eight terminals were allocated for teaching in the three institutions and at present over one-thousand students regularly use CAL materials on-line. The general aim of the project was to so integrate the material within the day-to-day teaching framework of the departments that its benefits would become clear and the institutions pay for its cost.

The Illustration of Concepts

Because of the difficulty in rapidly producing and processing numbers which can serve as sample data, statistical concepts are not easy to illustrate. To remove this problem, a statistical simulation laboratory (STATS) was implemented on the computing system. It can be used by teachers for demonstrations during lectures using a vdu terminal connected to cctv-monitors and by students for individual exercises at the terminal. The language has a series of commands which allow the user to set up populations, draw samples from them, display their values and have calculations performed on them. The outputs of these commands can be labelled and then used as inputs to subsequent commands. Since there is a macro-generating facility, STATS can also function as a simple programming language. Any output or named procedure can be saved and used on later occasions, and STATS can also be accessed directly from tutorial programs which are written in the Author Language. Using these facilities, teaching staff have devised exercises which illustrate, for example, the properties of the central limit theorem, and used them in conjunction with their course work.

Adaptive Test/Teaching Functions

The computer is not used for initial teaching and exposition - to a certain extent these objectives can be accomplished by more economical means, for example, through lectures or programmed texts. However, since feedback from text books and lectures is limited, there is a need for programs which individually test the student's understanding and provide the feedback and remedial teaching which is necessary.

The computer based material is structured by control programs which are specified by teachers. These operate and manage "lower level" small teaching

modules which are stored in the computer. (Approximately two hundred of these have been written and validated; they cover the topics appropriate to a one-year introductory course in Applied Statistics.) The control programs select and sequence the teaching modules - or sections from them - make decisions using performance data, and connect the sections together using appropriate comments provided by the teacher so that a coherent lesson is formed. The programs also store individual performance and time data, and print comments which show the student his position in the program. Thus he can pace his working sessions at the terminal. The control programs can be specified and implemented very quickly (approximately within the hour) and so the teacher for any topic area can construct material which suits his own particular approach and his own groups of students. The small Teach modules themselves provide the on-line instruction, independent calculation facilities, feedback and remedial teaching following student responses, and a HELP command which gives advice and hints on how to attempt the questions. If the student wishes, definitions of statistical terms can be printed for him, and a RETURN command also permits the student to browse and take different routes through the material. (Fuller specifications of these programs and the user manuals which have been produced are available from the Computer Based Learning Project at Leeds.)

Problem-Solving

An interactive example bank has also been produced which allows students to work through problems of the type which are commonly given in example classes. It is particularly suitable for the more able students who might wish to work through these problems instead of or before using the Teach programs. Typically the student will specify the example type and the curriculum area, and after they have been printed he will develop his initial solutions off-line. The computer will provide hints and a skeleton solution for some questions, but for others these facilities are withheld and the student is questioned about his answers and methods at the terminal. Feedback is given where appropriate. The system is macrogenerated so that teachers can easily develop material themselves by writing questions and supplying outline answers. Thus they can contribute to, and make selections from, this common example pool.

For those students who have completed the introductory course and who are studying aspects of experimental design, problem-solving material of a larger scale has been developed. Typically, an example is taken from the research literature and the student discusses and criticises the experimental design at the terminal. He is then required to construct his own plan. Data has been stored in the simulation programs so that he can then try out his decisions, process the data and draw his conclusions. Some details of this experience have been described elsewhere (Abbatt & Hartley, 1974).

From these various components, the teacher has to assemble his course. Which of the materials he prescribes, and the extent of their use, will be affected by the particular nature of his class, the topic area and his own inclinations. Although some departments have used the materials to reduce the workload of teachers and demonstrators, the direct replacement of teachers has not been an objective of the project. Indeed, the role of the lecturer is crucial for he is the coordinator of the material and the person to whom students refer. (It should also be noted that the teaching laboratories are run without direct supervision of staff. The students themselves take Guides and other materials from the filing cabinets within each laboratory. They use the terminals, and make any comments or suggestions about the programs on the printouts which they then place in the drawer of the cabinet. In case of difficulties, a telephone connection is provided to the Computer Based Learning Project at Leeds.)

EVALUATION

How should such large scale educational innovations be evaluated and what methods are appropriate for data collection and analysis? All the National Development projects are being independently assessed to establish both the educational benefits and the financial and resource costs, and some preliminary reflections of the evaluators are contained in the publication entitled, *The Programme at Two**. On a

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* *The Programme at Two* is available from the Centre for Applied Research in Education, University of East Anglia, Norwich NR4 7TJ

more limited level, some comments can be made about our experience at Leeds.

Usage of the System

A first indication of potential benefits is gained from the attitudes and activities of the users, i.e. the students and teachers. The teaching staff have to think out their coordinated policy and produce control programs. If these materials make little impact on their teaching problems, they will not be prepared to continue investing their time, neither will the department invest its money in paying for the recurrent costs. Similarly, if students feel the technique is cumbersome or boring, or that their learning is not repaying the investment of their time, they will not continue to use the terminals.

We have found no fall off in the attendance of students and the activities of staff. Indeed more teachers are participating in the work each year and their commitment is increasing with their experience. Student attendance is also very satisfactory - in some groups well over 90%. In fact usage of the system has doubled during 1975-76 from the previous session. (This is bound up with a deliberate policy of restricting student numbers until the materials had been thoroughly tested and validated, and until teaching staff had gained necessary experience. Even so, there has been an increased commitment on the part of students using the system.)

Performances

Another indicator is to consider the performance of students, both at the terminal and in sessional examinations. It should be noted that the Test/Teach programs referred to above manage the instruction for individual students by applying specified decision rules, and experiments which point to the benefits of such decision making in respect of feedback and task sequencing have been noted in the previous sections. In a sense the Test/Teach programs, through these decision rules, provide guarantees on the standards of performance which students must attain before they leave or transfer to other materials. Supporting data on the effectiveness of decision making and feedback was obtained, for example, in a study of the performance data of a sample of two hundred students working through the programs in Hypothesis Testing. The average working level of

success when students answered the criterion Test/Teach initially was 50.2% - showing they have much to learn. After having provided feedback, the programs usually noted the errors and at some time later within the program re-tested the student on similar tasks. The percentage level of success at this stage of the study was found to be 74.7%.

Some teaching departments also kept records of student performance in sessional examinations at the level of individual questions which were asked in the different topic areas in Statistics. One institution was also able to divide students into groups, some of which had example classes in the normal way and others which had computer based classes as a replacement. The favourable results of this initial study gave general support to the utility of the computer based materials.

Opinions

It is also relevant to consider the statements which students make about the materials and their methods of using the terminal. When the student has completed his work on each Test/Teach package, the computer programs ask him to make ratings with resepct to the following questions:

1 How well do you feel you understand the statistical topics covered in this program?

(1 Very well 5 Very badly)

2 How much did the program increase your understanding?

(1 Very much 5 Not at all)

3 Do you feel the computer used your time efficiently?

(1 Very efficiently 5 Very inefficiently)

4 Was working through the program interesting?

(1 Very interesting 5 Very boring)

A summary of this data for several hundred students is given in Table 1.

On two occasions during 1975, a small (approximately 10%) sample of undergraduates was given individual interviews. Other students were formed into small groups and in a less structured way were asked to discuss general themes relating to CAL, methods of instruction and sources of difficulty in learning Statistics. Larger samples also filled in evaluation questionnaires. A brief summary of the responses which were given during the interviews is difficult to make, but the following comments seem appropriate. Almost all students considered statistical methods to be of some importance in their subjects. Most considered that the success of Computer Assisted Learning should be judged in terms of the effect on student learning and in terms of added interest to the subject. Some thought the student performance data which were available to the teachers were a useful feature. The main functions of the Student Guides were considered to be revision and as a supplement to lectures, and some noted their use for reference at the terminal. Not all students used Computer Illustrations during the term, but most rated the STATS package as easy to use. Those who didn't thought it quite difficult and the Illustrations more appropriate to those with a mathematical background. The comments on the Teach material were favourable and reflected the ratings recorded previously. Students found the laboratory well organised and reported that conditions did not seem noisy and did not interfere with their concentration. They also featured Computer Based Learning in their time allocations for Statistics teaching with at least one working session per week.

The associated teaching staff were also interviewed and their opinions on the importance of Statistics, their teaching objectives, the functions of the materials and their value were sought. They were also asked to discuss the problems of integrated computer based learning materials within their teaching. Since the computer materials only formed one part of the teaching organisation, the interview ranged over other topics such as lectures, example classes and examinations. Again it is difficult to summarise this data for it showed that the different institutions and departments organise their Applied Statistics teaching in diverse ways. However, in all main subjects, Statistics was considered an important technique and teachers thought that trends towards quantitative methods would continue. Individual staff gave different functions to the lecture, some regarding it as a main source of

Table I: Student Ratings of Test-Teach Material

	Rating	Frequency	% Frequency
Q^1 Level of understanding of statistical topic.	1	74	12.4
	2	250	42.0
	3	126	21.1
	4	121	20.3
	5	25	4.2
		596	100.0
Q^2 Increase in understanding due to program.	1	91	15.3
	2	226	38.1
	3	106	17.9
	4	112	18.9
	5	58	9.8
		593	100.0
Q^3 Efficient use of time at the terminal.	1	209	35.2
	2	217	36.5
	3	80	13.5
	4	55	9.3
	5	33	5.5
		594	100.0
Q^4 Interest level of the program.	1	232	39.4
	2	207	35.2
	3	78	13.2
	4	45	7.6
	5	27	4.6
		589	100.0

information to the student, others considering that it provided an introduction and overview. Almost all departments attached considerable importance to the example classes and tutorials. The teachers differed in the ways in which they used computer based materials and Student Guides. However all the staff were satisfied with the additional facilities provided by the programs and reported that, in general, they were flexible enough in design and decision making to meet their needs. The teachers all believed that the computer programs were enhancing the students' learning of Statistics.

Costs

Making estimates of the costs and resources which are used in any particular situation is relatively easy, but the interpretation of the concluding figures is more difficult. Costs are very much dependent upon the size of the computer installation and the type of terminals. The types of program and their development costs, and the organisational factors which affect the usage of terminals, are also important and vary from one institution to another. However we can record some of the costings which have occurred at Leeds.

Using a dedicated computer which manages a fifty terminal system of which twenty-eight teletypes are allocated to the Applied Statistics project, the cost per terminal hour is estimated between £1.20 - £1.80 (1975 figures). These costs include depreciation of computing and terminal equipment (hardware), all development costs for the educational material, communication and GPO line charge costs, and charges for rent, heating and stationery. These charges are all-inclusive and, for a conservative usage figure of twenty thousand hours per year, terminal costs work out at £1.80 per hour. It is likely that our final utilisation figures will approach thirty thousand hours per year which brings the costs down to £1.20 per terminal hour.

In these estimates, any benefits coming from replacement of staff by computer based teaching materials has been ignored, although some departments have introduced reductions in the teaching load. This has not been true in other departments where the figure represents an add-on cost to present instructional charges. However, in the present economic climate when posts are being frozen or lapsed, computer based materials would allow teaching staff to deal more

adequately with a larger number of students. (It should also be noted that substantial numbers of students in all of the institutions make use of the Applied Statistics programs; such service projects gain cost efficiency and effectively reduce development costs by having several hundred students drawing on the materials.)

Conclusions

There is an obvious difference between research exercises which run a small number of programs, and a large-scale development project which seeks to integrate sufficient material within the day-to-day teaching of large numbers of students so that there is substantial progress in overcoming educational problems. The electronic computer is likely to make some impact through simulation, tutoring and problem-solving programs, usually in areas where more conventional methods are encountering difficulties. Such programs will increase the efficiency of the teaching process - whether these benefits outweigh the resources and costs is a judgement which institutions will be making during the next few years.

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The Keller Plan: Costs and Benefits of Self-paced Self-study

P J Unsworth

Introduction

Teaching innovations are frequently introduced by selecting a suitable existing course and using the new method in place of the conventional familiar approach. When the benefits and drawbacks are weighed up, however, the tendency is to assess these in terms of replacement value alone, asking how well the innovation succeeds in those areas where the old method was strong, or obviously fell down. Yet the innovation may possess features previously largely ignored and which may have long term benefits undervalued in considering replacement value alone. Such is perhaps the case with the so-called Keller Plan whose attributes are described and considered here.

As originally conceived by Keller [1], the Keller Plan is a method of teaching in which the course is divided into self-study units which students work through at their own pace, with tutorial help available if necessary. The units explain the aims and objectives for the study, and suggest a study sequence (usually book-based), and provide self-assessment exercises. Before he can move on to the next unit, the student must pass a short test when he is ready, to determine his mastery of the unit. Otherwise, further study and retesting is required. Tests are marked on the spot with the student by a course tutor, and difficulties and further study discussed. The non-informative title Keller Plan has lead to alternative names for the method: 'Personalised System of Instruction' in the USA, and 'Self-paced Self-study' in the UK.

The method is particularly suited to courses where mastery is important, either of skills, or in understanding and applying concepts, and has been employed

mainly in science, mathematics, psychology, and engineering, but also in language teaching and economics. The need to adapt the method to local conditions has produced many variants, including teacher-paced versions and shown the method to possess considerable flexibility. The main elements are self-study, and personal tutorial contact through consultation and the marking and discussion of tests, and reflect an emphasis on certain types of behaviour and outcomes which are now discussed.

Self-reliance

The self-study basis helps to promote self-reliance: the student has to master the material by his own involvement and effort. Development of self-reliance is undoubtedly one of the aims of higher education and can only be achieved by giving students opportunities to take on the responsibility of learning for themselves. The study units and possibility of tutorial consultation provide moral and actual support whilst the student develops the skills involved. Some teachers accuse the use of study units which suggest detailed reading and exercises as amounting to spoon-feeding. However, merely providing a syllabus and book list invites the undesirable danger always present in individual private study of reaching an impasse in which further progress is blocked by some failure of comprehension or reasoning, or some unrecognised, critical factor [2]. A prolonged impasse is demoralising at least, and can cause frustration and humiliation, and build up into a disrupting mental blockage. Unwitting selection of books which take the student out of his depth may cause this, so that guidance in the unit to suggest suitable reading and alternatives, and point out areas of difficulty, may be an important factor in helping the student to develop the ability and confidence to handle and select study material for himself. The student already possessing this ability can select his own scheme of study as best suits his style.

This encouragement, with support, of self-reliance through self-study is one of the features which has attracted teachers to use the Keller method instead of conventional lecture based courses. Students reporting their Keller experiences confirm that learning for themselves from books is a new and rewarding experience, different from using books after hearing lectures, and that they feel to have acquired an alternative and valuable addition to their

repertoire of effective study techniques.

Mastery and Personal Achievement

Mastery is also emphasised through the use of tests on the units. It is important apart from its obvious desirability in terms of acquired competence. Mastery achieved by a student's own efforts brings a sense of personal achievement and recognised success which reinforces motivation. It brings a good feeling, and aids self-confidence and the student's belief in his own value. It is the converse of the demoralisation possible if the student is left without support in a deep impasse. It is a potent motivating factor often ignored in teaching by not creating opportunities for personal achievement, or by not giving achievement due recognition. Success achieved in a self-study course may well have merit over the same success in a 'taught' course. Students often attribute success in the latter to 'good teaching', instead of recognising their own achievement. Their own part is clear, however, in success through self-study. (A longitudinal study of forty science students at the University of Sussex [3] indicated that at school they attributed their success in subjects in which they did well to good teaching, and where they did poorly blamed it on their own failings - which does not leave much room for personal credit!)

Individual Personal Contact

A most attractive feature of the Keller method is the individual personal contact established between students and tutors through the marking of tests and voluntary consultations. It is usually on a one-to-one basis, and though staff costs may limit the time per student to as little as ten minutes, both students and tutors seem impressed by the effectiveness of the interaction. This results from the student being properly prepared for the encounter by his study of the unit, and by having written a test on it. This gives an immediate focus for diagnosis and discussion which may be wholly directed towards that student's own needs and difficulties.

This ability to maintain, and in many cases, improve on the personal tutorial contact in conventional courses is an especially attractive feature of the Keller method. It overcomes the disadvantage of some self-study methods where the teacher is eliminated or where inordinate preparation time is bought at the

expense of student/teacher contact.

Self-pacing and Mastery of Coverage:

Since students progress at different rates, self-pacing is necessitated to some extent if mastery is required. And almost inevitably, if students are allowed to work at their own pace by not imposing deadlines for completion of units, then procrastination is encountered. The pressure of deadlines, which act effectively for many students, is exchanged for the encouragement that successful achievement brings, which is not enough for all students. Some degree of student procrastination is almost always found therefore with self-paced courses, which has to be balanced against the real benefits some students get from this freedom - to plan schedules of varied concentration, or sometimes to require an unexpectedly long time to master a topic. For some teachers, the procrastination is acceptable, though perhaps a worry. For others, complications from students not completing the whole of the course cannot be risked, and the self-pacing feature cannot be adopted. The response of students to self-pacing is mixed: many enjoy the freedom and benefit from its opportunities, whilst others honestly recognise that they work better when put under some pressure.

Most conventional courses, especially lectured courses, do not insist on mastery. Though written work is set, it does not usually have to be worked on until fully satisfactory - although resubmission of reworked essays or problems is sometimes employed and felt to be worthwhile. Nor is there much attempt to assess the degree of mastery across the whole range of ideas and associated skills contained in the course. Written work usually samples the course, and the teacher infers indirectly what is happening with the rest of the material. The effect is that students often cover most of a course but achieve only partial mastery or understanding. When people have converted existing courses to self-paced self-study with mastery expected (accepting the problems of defining and measuring mastery) it has commonly been found that the bulk of students cannot in the same time master all the material, which was only partially mastered in a conventional course. In a self-paced course, this shows up through students not being able to complete all the units. In some cases this has resulted in students experiencing and reporting a sense of failure, though their not meeting the unreasonable target of mastery of all the material. To

avoid this, the material to be mastered must be reduced so that mastery of part of the course replaces partial understanding of all the course. Students will still learn at different rates, so that by identifying the vital 'core' areas, and less important optional areas of the course, realistic targets can be set for mastery of the core material by all students, with further optional units provided for those able to progress more quickly (see Figure 1).

The need to reduce coverage if mastery is desired is consistent with the frequent overloading of syllabuses that many teachers feel exists in conventional courses, especially in lecture courses. That overloading can cause demoralisation is well known [4]. This is due in part to it frustrating possibilities for personal achievement by not allowing students time to explore and come to terms with new ideas, and which self-pacing allows. This unexpectedly showed up in a two term Quantum Mechanics course for second year students majoring in Physics at Sussex. The first term was a conventional lecture course with tutorial support. The second term was a self-paced self-study course, drawing appreciably on ideas from the first term. In 1975, many students used the self-pacing feature of the second term to spend up to three weeks resolving difficulties over the first term's course - which was somewhat excessive. Self-pacing was thus being used to compensate for differences in essential pre-knowledge. The result was a superbly good examination performance on questions relating to the first term, and reduced coverage for the second. In the previous year, on the other hand, when the second part was given in parallel in both lectured and self-study versions, comparison of the exam performance of students taught by each method had shown no significant effect, using for comparison their performance on the first part in which both groups had been taught by lectures. This is in accord with general impression in this country that the Keller method does not in itself significantly affect examination performance.

Using Undergraduates as Tutor/Testers

Perhaps the most fascinating feature of Keller's conception was to use undergraduates who had previously passed through the course to assist with testing and tutoring. This creates additional teaching resources and both tester and tested students learn through their interaction. In this country, testers

Figure 1: Completion Rates with Core and Non-core Units

Subject Area	No of core units	Percentage completing core unit	No of non-core units	Percentage completing non-core units
Vector Algebra	5	98%	1	70%
Complex Numbers	3	98%	1	51%
Integration	3	94%	0	-
Matrices and Determinants	2	100%	1	69%
Ordinary Differential Equations	2	96%	1	34%

(see reference 3).

have been drawn from undergraduates making rapid progress on the same course [5, 6]. The testers gain strong reinforcement from teaching material they have recently learned and, having just overcome the difficulties of a particular unit, may quite possibly be better teachers than faculty tutors. Certainly the testers report how much they had learned, realised, and revised through testing. They also felt the need for being properly prepared for the job of testing, though they learnt through their mistakes. Students receiving help from testers reflected this, their attitude towards testers becoming more positive, so that many students eventually preferred student testers, finding them more approachable, with a better understanding of their problems [6].

There may be difficulty over the acceptibility of undergraduate testers, and so far it remains a relatively untried resource. However, used as they have been with faculty tutors available to assist, and with students allowed to choose undergraduate or faculty tutors, it should be possible to set up limited evaluative experiments.

Variations upon the Theme

Spread of interest in the Keller method owes much to the activities of Professor Elton of the University of Surrey, and his colleagues at the Institute of Educational Technology there; and to the Higher Education Learning Project in Physics (H E L P). They have collaborated over the last three years and have run training and dissemination conferences and advised

teachers setting up self-study courses for the first time, and have monitored and evaluated many courses [7].

Those approaching those courses have been attracted very differently to the various features offered - self-study and self-reliance, personal achievement and mastery, individual personal contact, self-pacing, using undergraduates in teaching, and an alternative to lectures. However, the exigencies of local situations have lead to so many variations that perhaps Keller is the only person using his own method.

The simplest course structure involves a linear sequence which students work through in order (Fig. 2). The most important 'core material' may be placed in the first two-thirds of the units to reduce adverse effects form variations in pace or procrastination. The final third of the course which may not be completed by all is then to some extent optional. A more elaborate structure may include branching sequences giving students some choice over content and order of study (Fig. 3a) or over the depth to which they go (Fig. 3b).

A block structure has also been used (Fig. 4) with each block containing core and optional units. This allows self-pacing within the block, but to control overall progress, definite dates are set when the whole class moves on to the next block. This simplifies synchronisation with other activities - lectures, discussion groups, laboratory work - which can be incorporated within self-study courses.

Testing has also been varied to include written tests, essays, laboratory reports, verbal tests and group tests. In some cases passing tests has counted towards the final degree assessment (especially in the USA), partly to reduce procrastination.

Not surprisingly, self-pacing has been rejected by some teachers. They have expected students to learn by self-study, but to work to a set schedule, usually handing in written work instead of taking unseen tests. This also allows group discussions etc. to be timetabled into the course. Self-pacing does nevertheless operate in the sense that students differ in the amount of time they devote to the course. And some do not keep up with the reading. As with fully self-paced courses, they use vacation periods to catch up. The study units are then probably of greater assistance than incomprehensible notes taken from

Figure 2 Linear Sequence

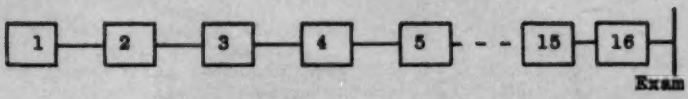
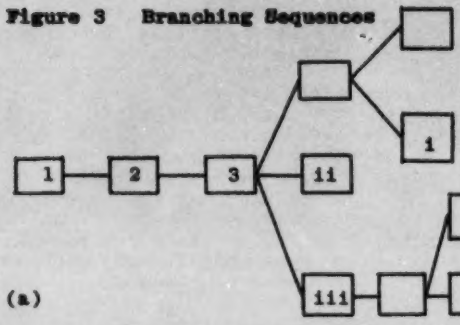
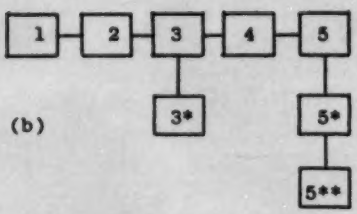


Figure 3 Branching Sequences

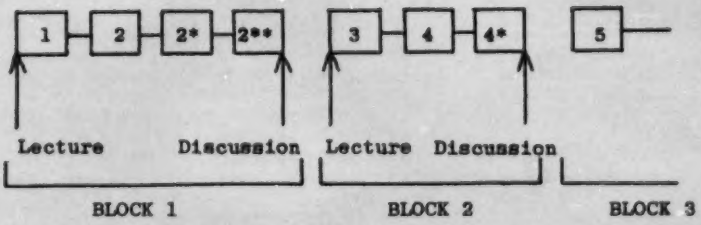


After doing 1,2, 3, students may choose any path, or do the units in any order so long as they complete i, ii, iii by exam time.



Students must do units 1,2,3,4,5. If they wish they can cover units 3 and 5 at greater depth by doing units 3*, 5* and even 5**.

Figure 4 Block Sequence



These examples are quoted from reference 7.

lectures.

Overall, the variations on Keller's theme have revealed great adaptibility.

Costs and Benefits

The particular features emphasised in the Keller method have been dwelt on at some length because, when compared with conventional teaching, and given the essentially equivalent performance in examinations, a considerable part of the benefit of introducing this type of self-study course stems directly from the new insights gained by students into the actualities of becoming self-reliant and learning for themselves, and from experiencing the satisfaction to be gained from personal achievement and mastery. These insights are probably quite personal: they may discover how much freedom or pressure they need to study effectively, or whether working steadily or in concentrated bursts suits them better. Learning from books without a lecturer first intervening to select, interpret, emphasise, and frequently mystify by using incompatible schemes of organisation or presentation, is a new experience for many. This experience and the confidence gained at being able to study independently and learn from books, and discover their own preferred style for effective study, stands to benefit all their subsequent studies. Apart, however, from reporting comments of students which do suggest that this may happen, it is difficult to assess the extent of such gains, because students themselves tend to compensate for variations in the effectiveness of different teaching methods. For instance, one might expect better examination results from a course which emphasises mastery at each stage. However, many students report that when the time comes for revision, they tend to understand and remember the material better than with conventional courses - so they spend less time revising, and transfer their effort to other courses, so masking any effect. Improvement in tutorial contact, however, is often real and welcome, arising because the testing/tutoring situation provides a better starting point for personal help and wider discussion than some other forms of tutorial teaching. The possibility of being able to use undergraduate tutors effectively has also been noted. So far, relatively few courses have tried this, but results have been encouraging.

Given such benefits, what are the cost requirements

in adopting a self-study course? For the logistic cost of a course to replace a lecture course of two or three lectures per week, typical figures would be two sessions of one hour per week, each manned by one tutor per ten students on the course. Tutors may be faculty or research students (or undergraduates). Whether the logistic cost differs depends on the class size and the extent of tutorial support associated with the lecture course. Fig. 5 shows actual staffing levels, and reveals considerable variation in practice.

Time required to preparing a typical unit based on a good textbook seems to vary between a few hours and a couple of days. Revision in the light of experience is usually straightforward, and in subsequent years very little time need be spent, and courses may be transferred to a new teacher without the complete rewriting common in the case of lecture courses.

Organisational aspects must be borne in mind, such as the availability of suitable rooms, and typists to produce units. Arrangements must be made to keep a record of student progress in tests, and to ensure units and tests are available to students and tutors as and when required, and to chase up students found to be lagging behind unduly. (The record of unit tests passed is found to give a good check on students' progress, and rapidly identifies students in difficulty). In addition tutors, especially research students and undergraduates, and also staff tutors, may need training and guidance. These are not necessarily more onerous organisational problems than with normal courses, but are not insignificant, especially with a large class.

Many of the lessons of experience and evaluation and analysis, and advice on preparing and running self-study courses, both Keller and variants of Keller, are collected in the book produced by the HELP project (8), together with case studies and sample materials.

Conclusion

Self-study methods have different strengths and weaknesses from other teaching methods. So, when it comes to comparing the resources required and benefits or drawbacks from conversion of a course to

Figure 5: Data on Self-paced Courses

Course	No of students	Year	CONVENTIONAL COURSE			SELF-PACED COURSE	
			Total staff hours per week			Tutor man-hours per week** S = staff and postgraduates, U = undergraduates	Students per staff man-hour
			Lecture	Tutorial	Total		
Physics (Sussex)	65	2	2	12	14	11S	5.9
Physics (Glasgow)	30	1	4	1	5	18S	1.7
Mechanics (Surrey)	70	1	2	7	9	10S+6U	7.0
Mechanics (Birkbeck)	15	1	1	0*	1*	1-2S	10.0
Mathematics	140	1	2	2	4	44S	3.2
(Southampton)	140	1	3	3	6	40S	3.5
Engineering (Lancaster)	30	2	2	0	2	3S+9U	10.0
Electronics (Royal Holloway)	13	3	2	0	2	2S	6.5

* Includes problem classes.

** Occasional extra lectures and man-hours spent on course management not included.

self-study, due weight should be given to those benefits (or drawbacks) which might have been absent originally. These may be of much wider value than purely for the course in question, so that if a narrow view is taken by looking for replacement value alone, they may be undervalued. This poses the problem: to appreciate the value of self-study, we have to assess the worth and even the degree to which we achieve some of the special benefits discussed - self-reliance, the satisfaction and motivation arising from personal achievement, good staff/student contact, choice over pace and degree of independence, using undergraduates as teachers. And how do we weigh these against possible drawbacks such as extra typing costs, reduction of coverage for some students, and the need and cost of teachers adapting to new methods?

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An Evaluation of an Application of a Self-learning Strategy at the Stockholm School of Economics, 1975

Monica Lindstedt and Harald Berg

1 A Brief Introduction

1.1 The Stockholm School of Economics

The Stockholm School of Economics, founded in 1909 by royal statute, is the oldest Swedish institution offering education in business administration and economics.

1.2 Programs

The School has three educational programs: a three year program for the Bachelor's degree, a one year Master's program and a four year doctoral program. The self learning experiment was carried out on the BA level.

During the first two years of the Bachelor's degree the students study business administration, national economics, law *or* economic geography, statistics and various optional subjects. This gives the student 80 credits. The basic idea behind the plan of studies is that the various subjects should be integrated with and complement one another. The aim is to enable the student to view economic phenomena as a whole and thus learn to look at a problem from different viewpoints, that of the enterprise, the community, the employees etc. This approach represents a departure from the traditional structure of studies in the arts faculties of most Swedish universities.

Although the School has a different structural approach to education at university level, the teaching methods are rather traditional.

During the past year however, there has been some

discussion about new teaching methods at the School. It has become more and more important to develop a complement to the traditional way of teaching since the need for graduates with an adequate knowledge of the relevant subjects *as well as* the ability to work in teams, to shoulder responsibility and to speak in public has grown.

Last autumn an experimental course was held for third-year students, the aim of which was to fulfil the purposes above. The main subject was "Organizational Theory and Personnel Administration".

2 The Background to the Course

The following is an attempt to describe the background to the course in Personnel Administration, autumn 1975.

2.1 Teaching Intentions

We wanted to use a teaching method which would enable the student to

- learn by investigating reality
- learn by trying to change the situation investigated
- actively evaluate information and impressions received
- form his/her own experiences, not only make use of the experiences of others

2.2 The Teachers

The teachers who planned and carried out the course had taken their ideas from the following areas:

- workers' participation and organizational development
- laboratory training and methods in group dynamics
- project-oriented teaching, eg management training (Action Learning) and other new teaching methods being developed at university level, especially from Denmark (Roskilde)

Most of the teachers are members of a research group, the Programme for Participation and Organizational Development at the Economic Research Institute at the Stockholm School of Economics, who are very interested in applying their knowledge and experience in different areas. The course gave them an opportunity

to practise in the field of education.

2.3 History of the Course

The course in Personnel Administration has, from the point of view of teaching methods, been rather traditional up to now. The teaching methods used have been confined to lectures and seminars. The students have had to read compulsory literature and write term-papers. However, it has been usual to invite speakers from different business and labour market organizations to give lectures in their respective fields, eg people from the trade unions, consultants and personnel managers. This has given the course somewhat of a special profile since it has not been usual until quite recently to invite people from outside to give lectures at the School. It has nevertheless proved difficult to engage the students in these courses. It has happened that no students at all have turned up for a lecture or else that many got up and left during the course of the lecture, to the great embarrassment of the organizers.

The first attempt to introduce a teaching experiment took place in 1971 when the course was started with a so called *organizational laboratory*. This was a three-day residential workshop where the students were required to create an organization of their own, with tasks and goals, a system of authority and work delegation. It was left to them to see to it that their new organization functioned properly and achieved the goals set up by the students themselves. The teachers' role was to act as consultants.

The purpose of the organizational lab was to give the students an opportunity to gain a personal experience of how an organization is constructed and which conflicts and problems can arise. The students were to teach themselves how to handle problems of motivation, leadership, effectiveness, involvement and participation. The teachers observed and commented upon what happened and helped to analyze the process. They did not take an active part in the work of the organization. The question of leadership and the assumption of responsibility was handed over to the students.

At the first lab in 1971 the students decided to build an organization to make a film about how they created their organization. During a period of three days and two nights the students worked intensively to build up a functioning structure with a leadership,

production group and administrative group. The film itself was made in a few hours during the last day.

Both students and teachers in their evaluations of the 1971 lab expressed the opinion that this form of education was both successful and worthwhile. To create an own experience of how an organization functions and then to analyze the process was thought a good way of learning, not only about the subject Personnel Administration but also for life.

The organizational lab has since then been a part of each year's course in Personnel Administration. But during the years 1971 to 1974 this part has been quite independent of the rest of the course. For a number of reasons it has not been possible to integrate the lab into the rest of the course. The teachers behind the idea felt however than an integration was necessary. They were invited to try these ideas in a course on Business Administration at the Swedish School of Economics in Helsinki, Finland in 1973, -74 and -75. During these courses the students took responsibility for their own learning and the planning of their own studies during a four-month period.

The 1975 group's organization took the form of a firm of consultants, the purpose of which was to carry out business administrative projects in various Finnish companies. The students used their "firm" to coordinate their projects and to facilitate an exchange of experiences. An important part of the process was to inform the other students about experiences won and to instigate a debate. The students also used their organization for bargaining with teachers about rewards and forms of examination and for bargaining with the different companies in connection with the projects. The organization also had a social function. Besides being a source of information it was also a place to meet. Guidance was provided for students in need of help and support.

The course we are now about to describe was planned and carried out on the basis of these experiences.

3 The Course

3.1 Objectives of the Course

The aim of the course was to give the participants a chance to learn as much as possible about

- what personnel administration is
- the basis of personnel administration in organizational theory
- the connection between values in society and personnel administration
- what kinds of methods and techniques can be used in personnel administration
- the basis of personnel administration in existing motivational theories
- how the Swedish labour market functions
- the student's own opinion on how to develop a personnel policy

The individual goals for learning were set by the students themselves. The idea behind this is that personal interest in a subject plus the possibility to set one's own goals promote better learning.

The teacher's role was to arrange seminars and to supply the students with information about the resources available to aid them in their work. The students were then to use these resources in the best manner possible in order to achieve their goals.

3.2 The Plan of Studies

The course consisted of six different parts:

Part 1: An Introduction

During the first week, the students were introduced to the subject through a series of lectures which gave a general orientation. The main purpose was to inform about the content of traditional personnel administration. Besides this the students were informed about the resources available for their use.

In order to help the students to find interesting areas for their own research, the teachers compiled a *Handbook of Resources* listing possible problem areas, and the names of persons willing to give help and advice or to visit the course as well as relevant literature.

Part 2: The Setting of Individual Goals

The participants were required to try and

define their goals within the framework of the course: what they wanted to learn about, how much they wanted to learn and how they intended to achieve these goals. This was accomplished through individual discussions with one of the teachers. These individual goals were regarded as strategies which might be changed at any time during the course.

Part 3: An Organizational Laboratory

The purpose of this three-day residential lab was to build up a well functioning organization among the students which was to plan and lead the remainder of the course. This should take into account the members' individual needs and demands for participation.

The laboratory also gave the members of the new organization experience of working in groups and of the concepts of group dynamics.

The teachers' role during the laboratory was mainly supportive. They observed how the students handled the conflicts and problems that arose and helped them to analyze the process.

Part 4: Term Papers

Each student was required to write a term paper on a chosen area of Personnel Administration. This could be done individually or in groups. The student was to learn as much as possible within the chosen area, not only by reading the literature but also by active research, eg interviewing people in different companies.

Part 5: Seminars

The teachers and other guests were invited by the students to speak on different aspects of personnel administration. (For the list of seminars see appendix 2.) These seminars were not held only in the traditional manner. The students also arranged panel discussions and showed films.

Part 6: Reporting of Term Papers

The aim of this part of the course was that the students should present their papers to

the rest of the group. Term papers were not necessarily required to have the traditional form. A sketch or a film, for example, was considered just as acceptable.

The Diary

During the course each student was required to keep an individual diary. The aim of this was to help the student to hold a dialogue with himself/herself and to constantly evaluate what took place during the course. The teachers continuously read the diaries and gave the students individual feedback.

Compulsory Papers

Compulsory papers on some of the required reading for the course were written by the students to show that they understood and could discuss the content of the books.

Examination

In order to pass the course it was necessary

- to take an active part in the course
- to write the compulsory papers
- to write a term paper
- to take part in the organizational laboratory.

The figure below shows the formal structure of the course. Besides this the students arranged many informal activities.

After the organizational lab the students had to make decisions on how to organize a literature pool, which speakers to invite and which films were to be shown. These decisions were taken at general meetings where all the students participated.

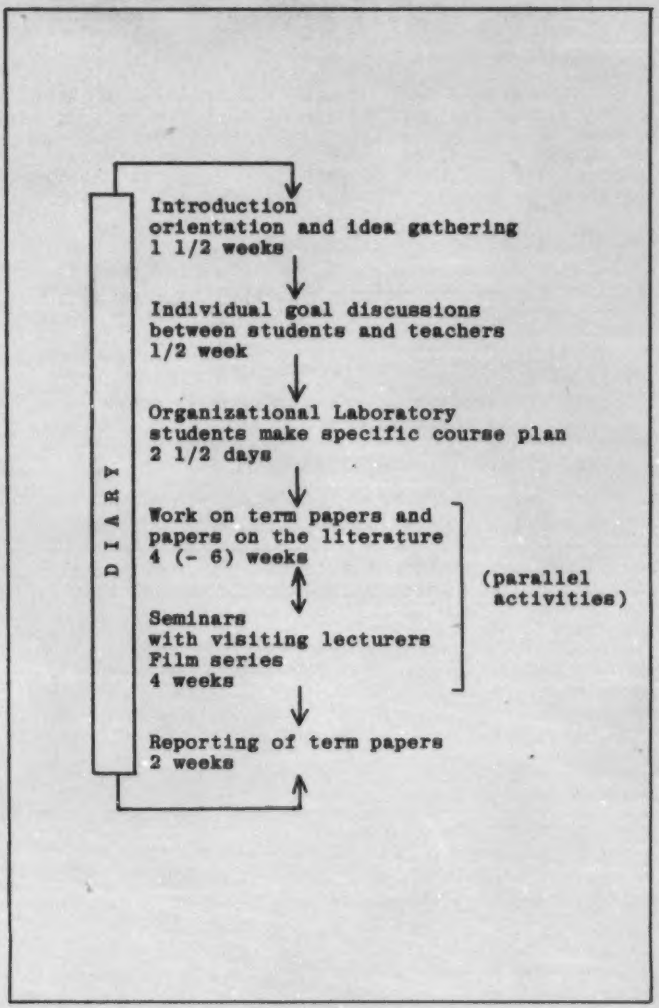
Besides these "task oriented" activities, the students also arranged parties and other activities of spontaneous character.

4 Results

4.1 What Happened - Some Subjective Reflections

The result was very positive. Neither the students nor the teachers believed at the start that the course would be as successful as it was. Between

Figure 1 **The Plan of Studies**



the traditional, and one might say even boring, introductory phase and the involvement everyone felt at the end of the organizational lab much had happened.

The setting of individual goals was perhaps the first "unusual" thing about the course. Each member had to write a letter to him/herself to find out what he/she expected and wanted to learn about the subject. As a guide the students had the *Handbook of Resources*. Each student then had an individual talk with one of the teachers where they discussed how the individual goals might be achieved.

Several of the students were very confused about the organizational lab. What was it really supposed to be? Was it some sort of sensitivity training?

4.2 The Laboratory

The whole course, both teachers and students, went off to a place in the country for a period of three days. Together we were to live, sleep and work out a plan for the rest of the course.

At the outset, the teachers said that they represented the Board of an organization and were now handing over the responsibility to the students. The students were to work out a proper plan for the course. This plan had to be good enough to be accepted by the School.

Some students immediately felt that they had to present something fast and came up with a complete plan after just a few minutes. The rest of the group were at first overwhelmed but after a while they began to protest. After having been given freedom they did not want to lose it again so quickly. The first plan was rejected and then a hard struggle for power began. Different camps each with their own leader were formed, each wanting their own plan to be accepted. The result of this was that it was decided that all decisions should be taken by the group as a whole at meetings in which everyone participated. At each meeting a new chairman was elected from among the participants. The chairman's task was to lead the discussion toward decision-making.

However, the debate about which plan to accept continued another twenty-four hours. During this

time the participants became very pessimistic and began wondering if they would ever be able to decide anything. Finally, out of sheer exhaustion, they split up the group of 40 participants into four smaller groups. Each group was to prepare a new plan to be presented to the general meeting. In doing this the students felt that they had not abandoned their democratic principles while it helped them in becoming more effective as well. The students were right.

The plan which was finally accepted was almost identical with the one presented at the start, but now everyone had thought it over and come to the conclusion that it was the best alternative.

The students now began to plan the details, eg how to plan the lectures, which speakers to invite, who was to be responsible for the literature pool etc.

On the morning of the last day a complete plan was presented to the Board (the teachers). This plan was also accepted (see Appendix 1).

During the lab the teachers played a very minor role. They participated in the general meetings and tried to analyze the process taking place.

What did the students learn from the organizational lab?

First, a strong feeling of being a group developed. This is unusual at the Stockholm School of Economics. This feeling of belonging to the group and learning to know the other members on a personal basis was a positive experience. From this the participants learned more about group behaviour, how groups function with respect to conflict and problem solving.

4.3 The Importance of Self-determination

Among the students there was a strong desire to do something that was fun, especially now that they for once had the power to choose. The exercise of self-determination was felt to be very important and the teachers were often criticized when it was felt that they took this power away from the students. But the students were not willing to take the whole burden of power. The task of reading and examining papers was handed over to the teachers. It was still

unpleasant to control each other.

4.4 Who Did the Talking?

In traditional courses there has often been the problem of "the quiet audience". Only a few - perhaps three or four students - have carried on a discussion with the teacher. During the introductory phase of this course the same pattern occurred, but after the lab more and more people felt safe to speak. At the end of the course there were perhaps five students of a total of forty who did not take an active part in the discussions.

4.5 The Diary

Writing the diary was a hard task for most of the participants at the beginning. Communicating with oneself is difficult if one is not used to it. During the first two years at the SSE the students only have to reproduce already existing theories and opinions, culled from books. To suddenly be forced to have an opinion of their own was somewhat of a shock. The students protested. After a time however, the diaries became longer and more detailed. Some of the students made brilliant analyses of the organizational process. At the end of the course, most of the students thought that the keeping of a diary was a good idea and a majority decided to keep it as part of next year's course as well.

The teachers noted that the papers handed in by the students became better and better, perhaps as a result of the "diary training"?

4.6 The Students' Involvement

At the end of the course, when all important decisions had already been made, the students' degree of involvement seemed to decline sharply. Meetings were long and tiring and no one seemed able to come to any decision about anything. There was no longer this intensive feeling of belonging and solidarity.

What we (students and teachers) learned from this was that it is necessary to have a common interest in order for a group as large as this to be able to work together. When the degree of involvement declines, the ability to make joint decisions will also decline. It is therefore important that the teachers support and stimulate the organization to ride out these

"doldrums", especially when this educational form is so new for the students.

4.7 What the Students Did

First, the students succeeded in creating an organization within three days. They then invited speakers to give lectures. A group of students was responsible for each lecture, which also meant being responsible for starting a debate on the subject afterwards. Besides this the students worked on their compulsory and term papers. The choice of subject and manner of reporting the term paper was left to the students. One purpose of reporting the paper was to give the other students as much information as possible on the chosen subject, another was to do this in the most stimulating way possible. The students used a lot of creativity and presented both panel discussions and role plays. The reports were very impressive and showed a deep knowledge of each subject. When the students chose the subject themselves it seemed to be more fun to work with it.

The term paper was a very important part of the course since its purpose was to compensate the exclusion of any other form of written examination.

4.8 How Much Did the Students Work?

On a traditional course at the SSE the student has to:

- read compulsory literature and pass a written examination
- make oral and written exercises.

Experience has shown that most time is spent on the first of these. The students have to study very intensively and the other requirement is of secondary importance.

On the course on Personnel Administration the students had to:

- take an active part in the course
- write compulsory papers on the literature
- write a term paper
- participate in the Organizational Laboratory.

All these four requirements had the same importance.

and the consequence was that the students had to work equally hard at each the whole of the time.

Besides the theoretical knowledge the course was supposed to give, the following effects can be noted: the students learned to take responsibility for their own studies as well as the course as a whole. There was also the possibility to develop other sides of themselves than the ability to pass a written test.

Learning to know the other members of the course informally was of great importance. This was made possible not only through the original idea of the course but also by having the same "classroom" throughout the course, where the students could always be, reading, discussing or writing their term papers. The literature pool of books and articles on the subject was also kept here.

In answer to the question how much they had to work on the course, a majority of students said that they had to work much more than on other courses. This can be seen in both a negative and a positive way. Positive because it shows that these teaching methods do not lead to the normal "just passing through" attitude. Negative in the sense that the more the students worked on this course the less they were able to work on other courses, at any rate when studies are organized the way they are at the SSE.

A little remark can be added. Although the students had very much to do, they attended the lectures to almost 100% (without these lectures being compulsory).

4.9 What the Teachers Did

Five teachers worked with the course. They had a lot of freedom in the sense that they did not have to plan more than the first two weeks of the course. The rest of the time their role was to be a sort of "free resource". They were to give help and support to the students when needed. At least one teacher had to attend each lecture or seminar where a term paper was presented. The teachers also had to read and examine the compulsory papers and comment on the diaries. But although no teaching in the traditional sense was carried out (except during the first two weeks) the course took much time; however, the teachers' involvement was as great as the students', eg they attended the general meetings as much as the

students did.

4.10 The Students' Evaluations

At the end of the course the students discussed the result. The majority thought that learning in this way was very positive. They thought that it might be difficult to work with traditional courses after having had this freedom. But it was more demanding to work like this as well. Students today learn things in a rather conservative way. One student said: "It was quite a shock to have to change the way of learning, but then I learned much more".

The method of diary keeping was, as mentioned before, much criticized. The students would have liked to have had a guide to how to write such a diary. "In the beginning it was so hard to communicate with myself." "Writing things down is to become aware of them."

Some students wanted to end off the course with an Organizational Lab. Perhaps the students' involvement would last longer if they had a Lab to look forward to when all other problems are solved, where they could sum up their experiences.

The students also felt that they would have liked to have had more support in their reading of the literature. They would have liked to have been able to discuss difficult parts more than they had the opportunity to do.

They felt that the teachers had sometimes been too "nice" (!). They wanted more critical opinions on, for example, the reporting of the term papers.

Some personal points of view:

Person 1

I would like to say something about my impressions and experiences of the course.

The plan in general: My final impression is very positive. This is a very good way of learning. There are many different advantages - cooperation, involvement, social contact. Everything leads to a greater motivation.

About the writing: We have done a lot of writing

during the course, something that I haven't been used to before. The idea of compulsory papers was good. At the beginning though, it was very hard to write, I think because I wasn't used to it. I am not so satisfied with the first paper but then it was easier. Time was a scarce resource and at the end it was difficult to coordinate work on the compulsory papers with work on the term paper.

The part of the course describing motivation was one of the best. This gave an important base for understanding many problems in our environment. I liked the literature on this subject and read a lot, it was really interesting.

The diary - oh, I have never accepted that idea! Having to write the diary has been a burden all the time. I haven't been able to use the feedback either. To write a paper with comments on the course at the end of the course would be much better. Well, I can understand that the diary is supposed to give some sort of continuity but it is still a bad idea. This must be discussed again.

The term paper: Work on the term paper resulted in some contacts "outside". This was positive, it is important to see what is happening around us.

Reporting term papers: This too was a good part of the course. Our capacity to work as "teachers" was better than I thought! I think that some things could be made even better, for example we ought to learn more about writing papers and acting as teachers.

Person 2

What the course gave me:

Self-confidence: It is easier now to speak in front of people, since I felt safe in the group during the course. I am now able to express my own opinions.

Time to read critically: The way the course was planned forced me to read books more critically. This was very stimulating. Unfortunately I don't have the time to do this in my other courses now, though it would be necessary.

Social contact: I think I've made some friends for life.

Ideas: Keeping the diary encouraged me to start thinking again. During the first two years at the SSE I haven't had the time to think any own ideas.

An identity: During the course everyone knew who I was. I wasn't just a number but a living person. I felt this together with both the other students and the teachers. We learned to know each other. Our discussions were real discussions, not just polite conversation.

Theoretical knowledge: When it comes to theoretical knowledge I'm not able to say anything now. When I start to work in a company it will be easier to say what was good and what was bad.

Disadvantages: Well, I didn't have the time to pass other exams during the course. It's not easy now to start reading other literature in the traditional way.

Person 3

The course has been different in many ways. I think it was very positive to let the students take responsibility for their education.

The Lab was a good thing. Why not have another, perhaps as a T-group?

It was a pity that the teachers were obviously afraid to give us total power.

I think it might be a good idea to use this teaching form in other courses as well.

I had to work hard, but it was stimulating and I think I can see problems in personnel administration from different points of view now.

For me, the effect of the course was that I became more aware of the goals for my studies.

Person 4

Good things:

- the possibility to learn about areas which were really interesting
- case discussions

Bad things:

- too little discussion about the economic consequences of participation and organizational development
- the feeling of being experimented with
- some boring term paper reports
- isolation from other courses at the SSE
- too little feedback from the teachers on term papers and compulsory papers. In some way the teachers were too passive
- the teachers did not act as the experts they really are
- the resources available to the student were not really defined
- the constant risk of a few students taking over and leading the course

4.11 The Teachers' Evaluation of the Course

The teachers felt in general that it was very stimulating to work with the course. It was positive to get such a personal contact with the students. They also felt that they had learned from the students.

Some personal comments:

Person 1

A stimulating course which gave an important contact with the students. A way to change the traditional relationship between teachers and students perhaps. The students showed a depth of knowledge on their respective subjects and an enthusiasm that was surprising. It will be interesting to see what effect this will have on the writing of their final papers.

Person 2

My comments only refer to my role as a teacher. I have other (positive) opinions about what the students learned, but this concerns only myself.

Compared to other teaching I have done at the SSE, this course has not given me any opportunity to structure and present my knowledge. It did not either give me feedback about how I acted in the classroom.

Instead I learned about how to plan such a course and how democracy functioned at the general meetings. I learned to know aspects of personnel administration I hadn't thought of before.

Teaching in the usual way is a stressful situation. During this course I didn't have the opportunity to feel proud of a single lecture but I didn't feel the stress either. I felt more like one of the students.

I was unsure about how much time I should spend on the course but I followed the principle of attending everything so as to be able to give comments on diaries and the compulsory papers.

Reading the diaries gave me an idea of what the students thought about the course but I also felt that I wasn't able to give them meaningful feedback and that was rather frustrating.

One of the most stimulating aspects of the course was the fine relationship established between teachers and students. One didn't feel any different to anyone else in the group and there was a willingness in the group to make something exciting out of the course, but perhaps this willingness was greater among the students than among the teachers.

During the course I learned a lot, I broadened my knowledge and learned new things.

Finally, the course gave me a nice feeling of belonging to a group, of working towards common goals.

Person 3

I think the motivational aspect was most important for the course. To start with, the students were really very willing to work and I myself felt very involved.

It was really fun to see that we could work out this idea as well as we (students and teachers) did. It was also positive to see that I could function in this new teaching role.

I have learned to know the students personally, which I appreciate.

I think the students gained as much theoretical know-

ledge in this as in any traditional course, but this course gave even more, for example they learned to find things out and to think themselves. Some of them became more self-confident. The course has developed the students on a personal level, and they had to learn to work in groups as well.

The students were perhaps too critical when they visited different companies. We ought perhaps to have said more about being respectful and trying to understand reality.

The course laid claim to the whole of me. Not just as a teacher, but as a human being. In some way it was a risk-taking as well. We could have failed.

4.12 Can a Course of This Type be Used for Other Subjects?

We who worked with the course during autumn 1975 are convinced that a course of this kind could be successfully used for teaching other subjects as well.

It has been said that it might be easier to hold a course like this on personnel administration than on other subjects. This is perhaps true, but it is still very important that even students concentrating on accounting, for example, or public relations, learn how to handle group situations, to take responsibility for their own actions and to read critically.

The main problem up to now is how to coordinate this course with other courses at the same time. This is a problem that must be solved before the next course in autumn 1976.

Other questions that still remain to be answered are:

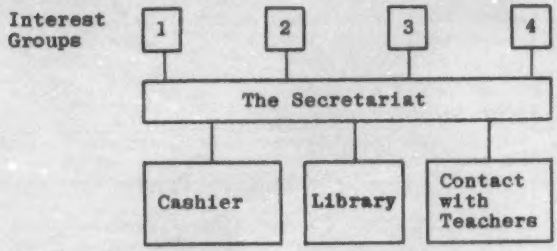
- How much of the positive result is due to the fact that this was the first experimental course?
- Does this kind of teaching suit all types of students? What to do with those who do not accept these ideas?
- What to do with those students who do not want to work in groups and do not even think that being a group is positive?
- How much of the "success" is due to the "Hawthorne Effect" that occurred, when the students knew that they were taking part in an experiment?

Appendix 1

Plan of the Course (made by the students at the Organizational Laboratory)

1 Goal
To supply the students with the possibilities to achieve their individual goals

2 Organization



a) General Meetings

After the first seminar a general meeting will be held each week: All decisions about the course will be taken at these general meetings.

b) Interest Groups

The students are to form four interest groups. These interest groups will be responsible for one week's teaching each. They are to supply the rest of the students with lectures and seminars.

c) The Secretariat

The secretariat will consist of eight members, two from each interest group, one of whom will be permanent and the other alternating. Two permanent persons are to take care of the library and keep contact with the teachers. One permanent person is to be cashier.

3 a) The Seminars

Eight seminars will be held during a four week period. Each interest group is to be

responsible for at least two seminars.

b) Term Papers

Can be done by each student individually or by a group of students

c) Reporting Term Papers

Can be done individually or in groups.

d) Time Schedule

A time schedule will be distributed to each member of the course

4 A *notice board* will be set up in the classroom. All important information is to be posted there.

5 Evaluation

a) After each reported term paper a discussion is to be held on the result

b) The teachers have the right to give extra tasks to students misusing (not taking) their responsibility

c) At the last general meeting the course is to be discussed with reference to its planning, content and experiences gained.

Appendix 2

What Happened During the Course

A Introduction (1 1/2 weeks)

Lectures

1) Presentation of the course
   What is going to happen
2) The concept of organizational policy and personnel policy
   A presentation of the Resource Handbook
3) Leadership
   Case study: Gränges Aluminium Co.
4) On information, communication and social responsibility
5) The Swedish labour market
6) Group theory
   Group exercise: NASA
7) What is personnel administration?
8) On motivation, rewards and salaries

B Setting Individual Goals

1) General discussion in the classroom
2) Individual discussions between students and teachers

C The Organizational Laboratory

First Day: Introducing the Lab

Second Day: Discussion on the organization of the Lab

Third Day: Discussion summarizing the Lab. Students present a plan for the course

D Seminars 4 weeks)

1) One of the teachers, Sven-Erik Sjöstrand, speaks on leadership
2) Film about a strike in a Swedish mining company

3) Guest speakers, the leader of the Confederation of Swedish Employers and the leader of the Swedish Confederation of Trade Unions, discuss wages

4) A guest speaker, Bengt Nilsson - a well-known Swedish "head-hunter" - talks about his methods

5) A guest speaker, the Managing Director of Platzer Bygg, talks about the problems involved in making a merger

6) Film: *The Innovator* - a film about problems that can crop up in connection with organizational changes

7) A guest speaker, P C Jersild - Swedish author and medical expert - talks on the role of medical practitioners in companies

8) A guest speaker, a Personnel Manager from Uddeholm AB, talks about creating a personnel policy

9) A guest speaker, the author Marit Paulsen, talks about quality of life

E Reporting Term Papers

1) Discussion: New Laws on the Labour Market

2) Discussion: Problems in Connection with the Introduction of Computers in Companies

3) Discussion: The Protection of Workers - Laws and Reality

4) A role play: How a Personnel Manager Employs People

5) Discussion: Organizational Change and New Forms of Cooperation in Swedish Companies

6) Discussion: The Position of Labour Union Members

7) Discussion of a case: Social Audit in a Swedish Company

8) Panel discussions with invited guests: New Dimensions in Personnel Administration

9) Discussion: Job Training in Swedish Companies

10) Discussion: Social Responsibility - What do Companies and the Government do?

11) Discussion: Bargaining on the Labour Market

12) Discussion: The Development of the Swedish Labour Market

13) Discussion: Motivation, Quality of Life and the Willingness to Work

14) Discussion: Causes of Stress and Other Psychological Disturbances in a Swedish Company

15) Discussion: Job Training in a Swedish Corporation

16) Discussion: Being a Boss, with Reference to New Laws and Today's Debate in Society

Flexibility With Control: an Example of a Classroom Contract and Some Other Attempts to Increase Effectiveness

David Warren Piper

This is a brief outline of a plan put into operation at the Architectural Association, School of Architecture by the author in 1970-72. Like the Keller Plan and Computer Assisted Learning and self-directed learning it was designed to meet the needs of a specific set of conditions. Hopefully, it will find wider application, suitably modified to fit circumstances.

The Operating Conditions

The AA school is independent and so such rules as it did have were easily changed. There were few bureaucratic procedures, no regulation about virement between budget headings, and no staff tenure. There *was* a jealously guarded tradition that students took a large responsibility for their own actions and that the primary duty of the staff was to help students achieve their own goals.

The staff-student ratio at 1:20 was lower than in university departments. The per capita cost of students was much lower. Figures for 1970-72 are not available but in 1973-74 the per capita cost of students was £821. The expenditure per student incurred directly by the teaching department was £158. The comparative cost of an AA student may be illustrated by more recent figures. For the year 1975-76 the cost of a university student was £2,740 per annum. An AA student cost £1,375. In 1970 as now the teaching at the AA was essentially a low budget operation.

The course led to Associateship of the Royal Institute of British Architects as does the course in an ordinary university department. The Association awarded its own Diploma in place of a university

degree. The Diploma is widely respected abroad and the School generally recognised as one of the leading European schools.of architecture.

One important feature of the school at that time was that there was no laid down curriculum in the second, third and fourth years. Architecture courses last five years with an additional year in practice before Associateship of the RIBA is awarded. At the AA, first-year students worked as one group with an organised programme. During the following three years they could choose to join one of a number of groups. Each group worked under a tutor with part-time support staff. The character of the groups varied,but with the exception of one group which was tightly programmed, the students were expected to take the initiative in deciding on their work programme. In the fifth year all students again came under an organised programme of study. The 'year out' in professional practice could be taken at any time to suit the needs of individual students. The students would be entered for the national RIBA examinations, both the intermediate and finals, at any time they chose and were judged likely to succeed. The total of six years had to be completed in order to qualify regardless of the stage at which the final examination was passed.

The intake of students for the two years 1970-71 and 1971-72 was forty-eight and sixty-seven respectively. About half were direct from school, some had previous experience in design or architects' offices, a few had previous academic qualifications. A little less than half were from overseas.

The author is not an architect but a psychologist who has specialised in teaching in Higher Education. Earlier work had included involvement with design courses. In 1970 he joined the London University Teaching Methods Unit and was immediately seconded half-time to the Architectural Association. Here he took full charge of the first year students, with responsibility for total organisation of their year's experience. It is unusual for a member of the University Teaching Methods Unit to act in other than an advisory capacity. In this case the school said: "Don't come to tell us how to do it; come and do it." It was a marvellous opportunity, a frightening challenge. Perhaps the author was not the only one to wonder if a bluff had been called.

The project began with no staff, no curriculum, no requirements to follow tradition; just some students, a studio, and one single budget figure from which to pay for staff salaries, equipment, travel, everything. Such freedom is never given in universities. It was an important and welcome aspect of the department but most of the important features of the course did not depend upon it.

It was normal practice in the school to appoint practising architects and designers to the staff on a part-time basis. Four days was regarded as the maximum; two or three days per week was the norm.

Not only did the lack of planning constraints allow an innovative approach to running the course, but the prevailing conditions positively demanded it. The salient conditions which the course had to meet might be seen as follows:

1) The head of the department (the author) had a knowledge of design methodology but was not an architect or a designer. The task was, therefore, to develop a system which provided: a 'core' curriculum expressed in terms which enabled the students' work to be planned and their progress monitored by the department as a whole, but which at the same time gave enough flexibility for staff to contribute their expertise and the freedom for students to work on 'live projects' as the opportunities presented themselves. A scheme was needed in which the special skills and knowledge of the educationalist, and the special skills and knowledge of the other design staff could be productively united. The watchwords were 'flexibility with control'.

2) The staff being part-time would have few opportunities for meeting as a group.

3) In the three years that followed the first year course most of the students would have to plan their own work programme. So in addition to their architectural work the students needed to gain the ability and perhaps the enthusiasm to work without a curriculum or timetable.

4) The staff-student ratio is difficult to compare with a department which has full-time staff as none of the teaching staff on the course in question had research duties. They did however have administrative work and sat on assessment panels in other parts of the school. In whole numbers the estimated

average ratio of staff to students (in full time equivalents) was 1:20. That compares with 1:8 in other architecture schools.

The Plan

In outline the plan was as follows. Learning objectives were written and arranged in groups. Each group was assigned some course time, a finishing date, a staff team, and a budget. At the beginning of the time allotted for each group the staff and students discussed how, if at all, the attainment of each objective would be recognised. They then described in writing the criteria by which success (for each objective to be assessed) would be gauged. The students contracted to be assessed according to the explicit criteria. The staff team and students planned a programme of work. The staff contracted to provide specific support needed for the programme. A record of personal achievement was kept for each student.

Some elaboration is needed to bring out aspects of the plan which relate to effectiveness and efficiency.

The Objectives

It was not supposed that all the purposes of the course could be encapsulated into behavioural objectives. The intent was to pursue efficiently those things which could be described in such a way in order to release more time for other activities whose justification would be in terms other than the pursuit of behavioural objectives. Those other activities might contain some of the more important elements of a worthwhile education, such as the making of personal choices without references to staff.

The objectives were produced as a written list which had been agreed by all the staff before the students arrived. The staff worked hard to reach an agreement on the *importance* of each objective because when the students did arrive they were given the opportunity of arguing for amendments to the list. Some objectives had to be met if a student was to be recommended for entry into the second year (although the lack of such recommendation did not necessarily prevent the student from being accepted). Most were

regarded as highly desirable and staff prepared their arguments to convince sceptical students that their attainment increased the probability of qualification or increased the satisfaction students would get from their work. Thus the staff worked towards a common view of the course which we might suppose added to their effectiveness in working as a team, and presenting a coherent and carefully justified course to the students. Students nonetheless were left free to disagree. They would end the year with a description of what they had and had not attained. Provided they met the minimum requirements (or even if they hadn't but still chose to) they would offer themselves to the second year tutor of their choice who, rather than having a grade, would have a profile of the student's achievements upon which to make his decisions and to offer advice. Here was another form of efficiency.

The theory of objectives writing, as for example presented by Mager (1968), recommends that an objective should have three parts: a statement of what a student is to do, the level of performance required, and the conditions under which that level is to be reached. However, the exact criteria of success and the appropriate conditions often relate to specific teaching activities, whereas the objective itself can be specific in describing the level of knowledge or skills of the student regardless of the particular circumstance in which he is to show it. Accordingly the first list of objectives often had only one or two of the three recommended features. They would be completed and interpreted only when a staff team and the students addressed themselves to the relevant group of objectives. Nonetheless all three aspects would be clarified before the students set to work. An example will illustrate the process.

Design students have to learn to relate the size of the objects they design to the size of the people who are going to use them. Take for instance a chair, which has several dimensions: the length of the leg, the breadth and depth of the seat, the height of the back,all of which must relate to the bodily dimensions of the people who are going to sit down. It is possible to design a chair for big people or for small people, in which case all the critical dimensions must be adjusted accordingly. It is no good having a back support suitable for tall people and a leg length suitable for short people because neither will be able to sit comfortably. The general learning

objective which would appear on the list of objectives would be: *each student will be able to design to any given population.* This would require that the student shows he is able to do three things: identify which dimensions of a design are critically related to human dimensions; relate all these critical dimensions to the same population of people; correctly adjust all the critical dimensions to suit any given population. Written in this way the objective is quite specific in describing what is required of a student by the end of a course but how he will demonstrate his achievement in a specific design exercise or theory class is left until the staff and students get together to plan their work. In this instance the most likely activity would be a design project. But the staff and students are free to choose what is to be designed. It could be a refrigerator, a fire escape, an office layout. The choice can be influenced by the need to meet other objectives within the same project, by the availability of 'live' projects, and by the interests of the students. Once the choice is made the exact criteria of success for each of the objectives may be chosen, for example, an agreement of what *are* the critical dimensions for a particular object, and the margin of tolerance acceptable on each.

As well as incorporating the efficiencies which derive directly from a student understanding just what he has to do and being given a say in how he goes about it, other advantages accrue from this method of specifying objectives. They can be combined in different ways and often taken in a different order allowing an enormous variety of work to be undertaken by the students whilst a very exact control can be exercised in what each student learns from his work. Opportunities for practical work can be taken when they occur. Students may offer themselves for assessment before work begins and, should they already meet criteria, be released from the need to pursue that particular line. Thus staff are able to concentrate their efforts where they are most needed.

By gradually becoming more and more involved in the writing of objectives and the planning of work programmes the students learned a self-sufficiency which it was hoped would help them during the following year when they would be entirely responsible for deciding upon and doing their work. Further the whole system set up rules for rational discourse and was flexible enough to accommodate persuasive arguments from students. The procedure itself was a

teaching tool from which staff and students alike might learn much about their subject, their intentions, and about education. Students were encouraged to use their individual flair, express their interests, and develop their judgements. They were given the opportunity of setting their own educational objectives as well as those required for qualification, to devise and try out their own means of learning, and helped to acquire the skills of assessing and monitoring their own performance. Further the system allowed for egalitarian social relationships between staff and student without the implication that the students' judgement on technical and educational matters was as good as the staff's.

Timetabling

The normal university timetable shows activities and, typically, is produced as a whole at the beginning of an academic year. The approach in the AA course was novel. The timetable was produced in three stages. The first two stages concerned the timing of objectives rather than activities. Only the final stage showed what people would be doing and the drawing up of that timetable was delegated to staff teams, sometimes to students.

The first stage was to decide on necessary sequences. Some objectives depended on another having been successfully attained first. Others were independent. The objectives had first been arranged in groups. Each group represented objectives which could probably be pursued concurrently; that is, some activity could be devised to admit them all. As each group was expected to lead either to a single activity or to a group of related activities, the groups rather than the individual objectives were put into an order. It was not a simple list but a diagram, part of which appears as Figure One.

Each box in the diagram represents a group of objectives. Figure Two shows a typical outline programme for half a term. The figures, One to Eleven, on the left represent the weeks of the term. So like a normal timetable, the diagram is a grid with a cell for each day of the term. It is easiest to illustrate how the 'timetable' worked by example. The diagram indicates that Project I has been assigned Mondays and Tuesdays, Weeks Two to Five. The reference number of objectives Nine to Seventeen is given. The cryptic letters are the initials of the

Figure 1: Architectural Association School — Plan First Year Course, 1970-71

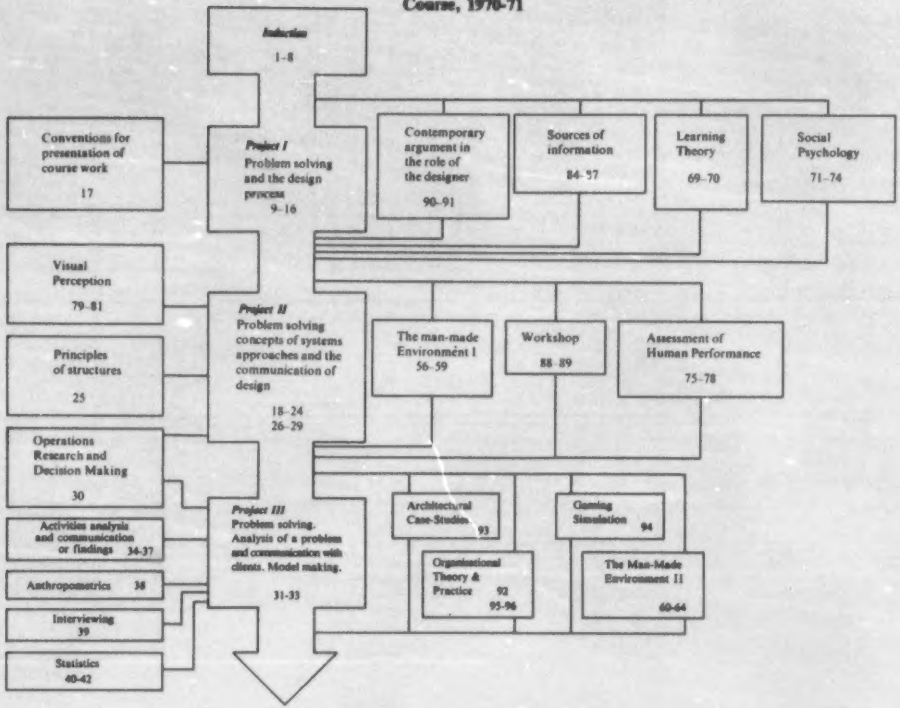


Figure 2

	MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		
1	DWP PBD JR JM	FS MF RE WK	DWP	PBD INDUCTION 1 - 8 CS	DWP	PBD JW	PO DS	SS Intro	INDUCTION DWP		
2		PROBLEM SOLVING AND THE DESIGN PROCESS 9 - 17			Sources of Information inside and outside the AA 84-87	Contemporary argument on the role of the designer 90 - 91	Arts and History Dept		Learning Theory and Small Group Psychology 69 - 74 DWP JR		Workshop II SS 88 - 89
3	DWP	PROJECT 1	DWP					Intro to Systems Studies JR			
4	PBD RE WK BG		HD KC PO		FS AH MF TW JS	JM FS DS HD PO CJ RE					
5											
6	Workshop 88 - 89 AH: 10 students	Workshop 88 - 89 AH: 10 students	Workshop 88 - 89 AH: 10 students	Workshop 88 - 89 AH: 10 students	Course Meeting		+WK	Structures 25 JL DR	Workshop 88 - 89 AH: 10 students		
11											

staff involved, those underlined indicate the coordinator of the team. It is important to note that the diagram does not imply that the whole of the students' time in those eight days would be taken up with Project I. There was an agreed limit to the proportion of students' time to be committed. Also there were some regular formal classes, three-four hours per week, which are not shown on this diagram. Rather what the diagram indicates is that in those 8 days the staff team could organise any activities, and use any of the facilities, space or equipment without further reference. If they wished to plan activities outside that time, they could do so by negotiation with the staff coordinators responsible for the days in question.

The third stage was a timetable which showed activities in the traditional manner, but was unusual in that it applied to only one block of time. In addition to the block programmes, the students took it in turn to produce a weekly timetable.

This approach to timetabling is another attempt at increasing efficiency. As with the writing of objectives the theme is flexibility with control.The more familiar timetable which details all activities for the coming year or term may be a work of art but it has two disadvantages. Typically its composition becomes a mammoth task undertaken by some unfortunate individual left to reconcile the demands of classes competing for space. The teachers often feel at the mercy of an unseen arbiter who necessarily works in ignorance of their exact needs, with the result that inappropriate rooms may be assigned and thus facilities not put to their best use. The second difficulty with comprehensive and pre-determined timetables is that they are difficult to adapt to changing circumstances. Rooms which on paper are committed stand free, organisers of classes which require at the last minute some unforeseen facility are left, at best, in a weak bargaining position. By delegating the administration of timetabling and resource allocation to the people involved and postponing decisions until work places have been finalised the best allocation of space and facilities was possible.

Financial Control

Here again a novel approach was taken. The whole first year was run on one budget heading. Initially

there was no separation of funds for staff salaries, upkeep of the studios, and recurrent costs of the course. First a proportion of the total sum was committed to staff salaries and some expenditure went on decoration and some furnishings. The rest was put to running the course. Each group of objectives, that is, each box in Figure One or Block in Figure Two was allocated a budget. The staff team was free to spend the budget how it liked, but all expenditure went through the departmental secretary who kept an account. Each staff team would discuss the allocation of resources with the students for each part of the programme. Each half-term there was a general meeting of all staff and students at which an account of expenditure to date was given and variations of the proposed budget for future activities discussed. All members of the department, including the students, were kept in touch with the financial position. The intention was to enable everybody to feel some responsibility for financial restraint and, in return, allow a genuine participation in deciding between priorities on such matters as visits, organised events, visiting speakers and the materials for projects. Again, flexibility with control was the theme: the strategy seemed to work well, and the department was one of the few which kept within its total budget.

Conclusion

The Architectural Association School has some unique characteristics which allowed this radical approach to education to be put into practice. That does not mean, however, that none of the features of the programme could work within the rather more formalised bureaucracy of a university.

What evidence can be brought to support a claim that the procedures described above contributed to effectiveness and efficiency? To quote success rates of students in their later examinations would be inappropriate. Success depended on the content of the course as well as its form. The content was different from previous (and later) years, so comparisons would yield very little. Neither was there a control group of students undertaking the same syllabus under a more normal regime. Such an approach to evaluation would also require a separation of the features described.

One is left pointing to immediate effects, as has

been done in the text. Perhaps it is legitimate also to point to the cost of the scheme which was lower than most university teaching.

A more detailed account of the AA course is in preparation and will hopefully soon be available. Perhaps the application of the plan (suitably modified) in a variety of subjects and in different kinds of institutions will allow for a more systematic evaluation. However, in most respects the plan was no more than the application of principles of planning and man-management which are already well established. Humans are humans whether in industry or university. We should not be surprised if what has already been shown to be effective in one also works well in the other.

Problem Solvers, Publishers or Pressure Groups? Some Comments on Inter-institutional Collaboration in Higher Education

Eric Hewton

There are now five major Nuffield sponsored inter-university projects under way. These are the Physics Interface Project (PIP), the Higher Education Learning Project, Physics (HELP), the General Education Engineering Project (GEE), Science in its Social Context (SISCON) and the Joint Universities Genetics Course (JUGC). The Inter University Biology Teaching Project (IUBTP) completed its formal activities two years ago. The six schemes between them will eventually account for something nearing £¾ million in grants from the Foundation. At today's prices this is close to £¾ million.

Together they are a significant innovation insofar as they represent a major attempt by groups of Universities and Polytechnics to tackle problems of teaching and learning on a co-operative basis. It also seems probable that their like will not be seen again; at least not as formally funded schemes.*

What each Project seeks to achieve could, theoretically at least, be undertaken by individuals or departments quite independently. The very existence of the Projects, however, indicates an expectation that the process will be more effective, or cost effective, if carried through as a joint venture. Also, there is an implied assumption that the very act of combining forces in this way will lead to a growing realisation of common problems, a greater readiness to collaborate to further the improvement of teaching and learning. This assumption was clearly backed by the experience

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* It should be mentioned however that the Nuffield Foundation now operates a small grants scheme to assist individual departments with teaching and learning developments.

of the Foundation in the field of curriculum development at the primary and secondary school level.

In effect, considerable *faith* is placed in the notion of *co-operation* and it is important that the meaning and implication of this concept, in the present context, should be carefully considered. The opportunity for co-operative action is provided by the 'superstructure' of the project and this is represented, in real terms, by the co-ordinator(s), secretarial assistance, accommodation and budgets for travelling, meetings etc. In effect this can account for up to about a third of the total cost of each project. The remainder is used to buy release time for the academic staff who participate in the various activities, to pay for research fellows to assist in the work and to cover typing and reprographic costs.

The Nuffield Foundation were clear about the kind of major 'spin off' benefits which they hoped co-operation of this nature would produce. In their Annual Report, issued at the time the first of the Projects was being funded, they suggested that;

1 'Each project would bring about more effective use of teaching resources.'

2 'Results would benefit more than one institution.'

3 'Lessons learned in carrying out the project would be usefully applied in other areas of University teaching.' (Nuffield Foundation 1969).

These aspirations form a backcloth against which the Projects themselves can be viewed. Each Project has its own aims and these are set out briefly in the short profiles in the Appendix to this paper.

It is too early, as yet, to judge how far the projects have succeeded in achieving their aims or how far 'Nuffield' hopes have been fulfilled. Nevertheless, there are a number of points which can be made and these can be linked with the question implicit in the title of this paper - are the Projects, in effect, 'Problem Solvers', 'Publishers' or 'Pressure Groups'?

This categorisation attempts to distinguish the styles which have emerged as the projects have organized themselves. The teams may not see themselves in this light and some may object to the

terminology but there is some justification in the description. Problem identification is generally the first step which precedes the proposal submitted to the Foundation. Large classes, students of mixed ability, outdated courses, absence of suitable teaching and learning material are the kind of problems which generally appear in submissions and the raison d'etre of the project is to help in solving one or a number of these problems.

The problem solving and publishing functions are often closely linked: four of the Projects have devoted themselves almost entirely to the production of learning materials and a fifth has used about half of its resources for this purpose. The dissemination of these materials normally requires publication of some kind and the extent to which the Projects involve themselves in this role is discussed later. But should the activities of the teams rest at the publication stage? Is the production of materials the most appropriate solution to the various problems? Might it not be more important to persuade and help teachers to change their approach to teaching and learning? If this is the case then it would seem that at least part of the work of the teams will cast them in the role of pressure groups. This paper considers the Projects in the light of these three potential functions.

There are six Projects under consideration and to attempt a summary 'evaluation' of each would be an interesting exercise but one fraught with difficulties. Each statement could always be challenged, defended or qualified and comparisons would inevitably be made by readers not fully conversant with all the facts. Such a task must therefore await a much more detailed and comprehensive study of the various enterprises. It is proposed here to raise more general questions which apply, in one way or another, to all, or most, of the Projects where this is relevant to the matter under consideration. One exception to this procedure will be a slightly more detailed consideration of the first and therefore the 'elder statesman' of all the Projects, the Inter University Biology Teaching Projects. Because it pioneered the way, it was the first to encounter the kind of difficulties which all of the others have met in one form or another. The others might have learned much from it but whether they have or not is in some doubt. Finding the time, the absence of a detailed evaluation, a lack of interest and communication between the separate discipline groups,

the problems of translating experience from one field to another all conspire to prevent this kind of learning taking place. But to return to the Biology Project it will be apparent from the profile below, that it was not only the first but also the most expensive of the Projects. It sought to investigate the possibilities of independent learning and the use of multi media self instructional materials in biology courses and the extent to which these might assist in overcoming problems related to large groups of students of mixed ability and mixed background knowledge (Dowdeswell 1972).

The degree of actual co-operation in the preparation of these materials was fairly small. A working group for 'writers' from the participating University departments was formed and met several times a year to discuss teaching problems in biology and ideas about their work.

The notion of independent learning in biology (particularly as exemplified by Posselthwaite and others (1969)) was carefully explored and largely accepted by the group as a basis for their work. Once areas, or themes, had been agreed and allocated to the various departments, however, the task of preparing the materials took place in the separate institutions. They each went their own way and although there was some interchange of materials this did not reach a stage which might be termed 'collaborative testing of project materials'. There were, in fact, trials but these were generally organised separately by each University and tended to involve local institutions with whom there was already some contact.

Each University, once it had been allocated its agreed share of the funds was, within limits, free to use this as it saw fit. In some cases the money was used to buy in extra teaching help in order to allow the project member time to prepare the materials. In other cases a temporary appointment was made and the 'project assistant' produced materials under the supervision of a project member. There seems little doubt, in retrospect, that the latter procedure led to more problems and, in the long run, produced less satisfactory results than the former.

How many institutions will eventually benefit from the materials produced by the Project remains to be seen. Some of the materials (from Birmingham, Glasgow and Sussex) which have been or are about to

be published will certainly reach a wider audience but again the question must be asked as to whether a collaborative project was necessary to achieve publication of this kind?

As far as the final Nuffield aim is concerned - 'that lessons learned would be applied in other areas of University teaching' - there does seem to have been some progress. At least four members of the original team are now engaged full or part time in curriculum development work, educational technology or consulting within their own institutions. Two members of the team were also invited to join, and have played a major part in, the later Genetics project (JUGC). There is little doubt that the experience gained did prove commonly valuable to most of the participants, and some of their departments. It might be added however that it is an expensive way of providing such experience!

This is a very limited description of the Project but it is primarily intended to illustrate some of the issues which are pertinent to the present discussion and which have a bearing on the aims and aspirations which surround such ventures. We might now generalise the discussions and consider the various strategies which were adopted by the Projects and how they have helped or hindered the achievement of the various aims.

Problem Solving and Publishing

The initial problems identified by a Project group are, as a rule, of a fairly general kind but once the team begin working together more specific areas for attention usually emerge.

Thus, the Physics Interface Project, which was concerned initially with the problems which the mixed A level background of students present to physics teachers, eventually turned its attention to three specific areas of difficulty - Mathematics, Optics and Electricity. These themes formed the main interest of the Project and working groups were established to produce diagnostic tests and remedial materials related to them. In so far as the areas were correctly identified and assuming that the materials do provide substantial help to teachers and students who encounter the 'interface' problem then it can be argued that the Project has succeeded in what it set out to do. This might also be said of

the SISCON, JUGC, and to some extent, GEE Projects. But what if only the participating institutions use the materials? The traditional way of overcoming this is by publication.

A publisher's role, by definition, includes dissemination, and advertising and marketing are thus built in to the publishing function. Part of the Inter-University Biology output has the backing of Cambridge University Press and Longmans and the Genetics Project has the publishing expertise and outlets of the OU.* The GEE Project is still seeking a commercial publisher for some of its materials whereas SISCON and PIP have in effect decided to 'go it alone'. The former is using a small educational printing unit in York (which is convenient and reasonably cheap and expeditious) and the latter, for similar reasons, is using the Press at University College, Cardiff. Both of these Projects must, therefore, act as their own agents in matters of publishing and dissemination. How many copies will they sell? This is, admittedly, only one criterion of success but it is a pretty important one for those concerned with matters of cost effectiveness. The outcome will be observed with some interest.

There is in any case the question of whether the production of teaching and learning materials is the most effective solution to the various problems. Their production may have been stimulated by the success of some of the earlier primary and secondary schools projects in the 1960s (see for instance an analysis of Nuffield Junior Maths materials sales: Hewton 1975). That this solution may not be quite so appropriate in the higher education sector is something that may yet have to be faced. A few people however are coming to the conclusion that materials may represent only a very small part of a remedy which in any case needs to be used sparingly and only after considerable thought has been given to other possibilities (see also Eraut et al 1975).

Pressure Groups

It has been said on several occasions, by members of the Project teams, that what they must do is change the attitudes of those they seek to help. By this they mean indicate to them a need, convince them that

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* although to what extent sales will be mainly to OU students remains to be seen.

there is an answer and provide them with a solution (usually in package form). Commercial publishers are hardly up to this task and other possibilities must be considered. These have been many and varied and the success rate has ranged from 'promising' to 'very uncertain'. Some of the more interesting ideas, (which incidentally many secondary and primary school orientated projects had already discovered) are worth noting.

Trials as Dissemination

The testing of materials in a number of institutions is generally regarded as an essential part of the development process. Whilst not denying the importance of this aspect of the work, it is apparent that, the more institutions that can be involved at this stage, the more will the Project become known before any official publication. Hopefully those involved in testing will 'get hooked' on the ideas and the materials and form the nucleus of a ready market at a later stage. Most of the projects have used this idea (wittingly or unwittingly) at various times and with varying degrees of success.

Consultation

This is an extension of the previous notion. Potential users of materials are invited to form a consultation group whose views will be carefully considered and whose ideas will be incorporated in the materials wherever possible. The HELP project has adopted a version of this approach on occasions but the outstanding example is the recently formed SISCON 'court' with over 50 members. This kind of consultation should be distinguished from the function which the 'formal consultative committee', referred to later, performs.

Collaborative Research

This is similar to the above but is probably far more potent. It seeks to involve groups of teachers in examining teaching and learning problems in connection with their own discipline and drawing from their possible solutions (the heuristic approach applied to the teacher instead of the taught!) GEE has used this approach in connection with the development of its 'Urban Crisis 2000' programme but the idea has been further extended and developed by the HELP group. HELP is described more fully in the paper by Professor Black but it should be mentioned here that some of the original participants assumed

responsibility for organising the work of sub-groups concerned with 'self paced learning', 'laboratory work', 'tutorial teaching', 'projects' and 'student motivation'. These groups have sought to involve interested teachers from a wide range of institutions and have apparently succeeded at an early stage, in widening the base of the project whilst at the same time starting to tackle the 'attitude change' problem. From these groups will eventually emerge 'materials' but these will tend to take the form of information and guidelines for which the need was identified by teachers and to which they contributed (HELP Newsletter 1976).

Conferences

The conference is a popular ploy. Ideas and materials can be displayed at a Project organised conference or, more economically, at somebody else's. The various professional bodies can sometimes be persuaded to run educational conferences and these provide a useful forum for dissemination of information. Attendance at international conferences can be important for Projects with export orders in mind: GEE and SISCON have been active in this field.

Training

The idea behind this is that teachers will need help in using the materials or methods effectively. Workshops, usually of two or three days duration, are therefore organised to explain and demonstrate the new approaches. HELP has probably been the leading activist on this front.

It might also be noted that SISCON has recently received a 'continuation grant' from the Leverhulme Trust, which it will use partly for training. The co-ordinator is presently negotiating with two or three Universities to provide a longer training course for science teachers who will in future devote more of their time to teaching the general aspects of science using SISCON materials.

Contacts

The co-ordinator has many roles but one of the most crucial may eventually prove to be his ability as a super salesman/diplomat/fund raiser. He will seek to obtain support not only from Heads of Department but from external bodies which might influence them. How helpful it would be for, say, the GEE project if

the various Engineering Institutions were to suggest that, wherever the 'Engineer in Society' is taught as a part of a course (from which students will eventually present themselves for professional recognition), GEE materials might be used to support the teaching and learning.

External support may also be sought for continuation funding. The limited life span of a Nuffield Project may not be enough to achieve the sometimes expanding aims of the group. More time and more funding may be regarded as essential if the real impact (which often seems so near) is to be achieved. None has tried harder in this respect than the GEE project but this at a time when the economic squeeze seems to have prevented success nearly every step of the way. SISCON, as mentioned earlier, have recently been more fortunate.

What Has Been Learned?

The discussion, so far, has indicated areas in which success in achieving the various aims might be predicted, or alternatively seriously doubted. Progress towards achieving the more effective use of teaching resources is perhaps the most questionable of all. Only if the Projects themselves undertake follow-up evaluative studies will it be possible to make any informed judgement in this respect but the prospect of obtaining such information looks slim. Nuffield do not insist upon evaluation (as for instance might Schools Council or the DES) and the Projects have generally set little or no funds aside for this activity.

The spread of results to other institutions is contingent upon the success, or otherwise, of many of the strategies referred to above coupled with the energy and expertise put into publishing activities.

The lessons learned and their applicability to other areas of teaching however is something which still has to be considered. The Nuffield Group for Research and Innovation in Higher Education (GRIHE) have always shown an interest in the activities of the Inter Institutional Projects (Nuffield 1974) and have called upon the experience and expertise of their members on numerous occasions. It was with the aim in mind of learning more about the operation of the Projects and possibly promoting greater co-operation between them that the GRIHE group organised

a seminar in March 1974 which was attended by all the Co-ordinators. Some of the more important points to emerge from that meeting and from subsequent correspondence are detailed below.

People

The Projects are normally termed inter university or inter institutional and as such they comprise representatives of several departments usually in the same subject area. These representatives may view their role very differently. Junior staff may expect to be fully involved in all activities including writing whereas senior personnel may anticipate participation only in broad decision making. A project comprising a majority of either group has its disadvantages.

Junior staff may carry little weight in their department. If they do not succeed in convincing the Head of Department and their colleagues of the importance and relevance of their work, they may remain isolated, cut off from the facilities they need to carry out and test their work. A Project comprising all senior staff however may also face problems. Staff cannot simply be directed to become involved or if they are there is little likelihood of them raising sufficient enthusiasm to produce good work. Ideally a Project should involve and have the full backing of senior and junior staff in a Department (Rose 1976). The reward structure however usually militates against this. The activity is essentially concerned with teaching and involvement will generally be at the expense of more highly regarded research.

'Outsiders' may also be employed by a Project. The experience with 'Project assistants' contracted for one, two or three years, usually to produce materials, has been mixed. They have no continuity of employment and therefore no real commitment. Often far too much is expected of them and the many skills necessary for producing 'good' material are usually underestimated. Their supervision may be good, bad or indifferent according to the particular work load and interest of their supervisor. SISCON who have employed this method of production almost exclusively are well aware of the problems of 'quality control'.

The payment of fees to outside specialists is another approach which has its problems. The expert wants to do it his way and this may not be what the Project wants. The need for rewriting and consequent delay

may well be the result. More than one project has experienced this difficulty.

There is another important consideration which should be mentioned here. Money has, (at least in the past), been made available to assist in finding solutions to some of the problems recognised in teaching and learning in Higher Education. But money will produce results only if people with interest, expertise and the ability to work well in project teams are prepared to take up the challenge. Experience has shown that although such people exist their number is as yet very small.

Support

The isolation of team members, which frequently happens, can prove detrimental to the individual concerned and to the project as a whole. The production of materials is a creative and highly demanding task for which regular feedback and moral support is needed. The writer is exposing his ideas, knowledge, teaching style and philosophy to a potentially wide audience. In order to do this for any length of time he needs regular reassurance that his ideas are sound and that he is producing what is expected of him. Regular meetings with others engaged in the Project are useful but these can be expensive and time consuming and this still provides only part of the answer. Ideally the work should be done by groups of two or three working closely together and each acting as a 'sounding board' for the other. There is some evidence that where this has been possible the outcome has proved to be more than normally successful. In contrast isolation from central support can also lead to a form of departmental introversion mentioned in the next section.

Control

This is an important issue on which to end this discussion and one which raises some basic problems for co-ordinators.

The co-ordinator occupies a central role in what is often a fairly complex power/authority structure. He, and in some cases a small executive committee, assumes responsibility for formulating and carrying out an agreed policy. But activities contributing towards this are often widely spread as development work takes place within individual institutions. It is not therefore surprising, nor unnatural, that

the ideas and materials produced should be related to the background and need of the departments from which they emanate. The kind of autonomy which seems to be necessary, particularly for the development of curricular materials, may run counter to the central aims of the project itself. The image of each participating institution happily engaged in solving its own problems rather than those identified by the Project is perhaps unfair but it is a tendency which exists and which some of the Projects have found it difficult to overcome.

But there is another aspect of control in which the co-ordinator is particularly involved and that is the pressure and direction which may be exerted on the Project from the outside. The Nuffield Foundation not only have their own aims in connection with inter institutional collaboration but they also have an interest in seeing that a Project, at least, attempts to achieve what it was originally set up to do. There is no demand for an evaluation (this would normally be too late anyway) but rather a safeguard is built in, in the form of a Consultative Committee. Such committees, which comprise members with a wide range of interests, meet the Co-ordinator and members of the Project team two or three times a year. They can be of considerable benefit to a team and provide a range of expertise and experience relating to the subject, to teaching, to publishing or to Higher Education generally. Their advice is normally readily accepted by the Co-ordinator but there have been cases in which basic disagreements have emerged. The Foundation may also seek to protect itself by agreeing to further funding only after a pilot stage, lasting one or two years, has demonstrated that the Project is on the right lines and progress towards achieving its aims is feasible. This does not make the co-ordinator's job any easier and it must add to the general uncertainty in which the Project exists. Nevertheless it might be argued that some form of accountability is necessary if the more effective use of grants, usually ranging from £50,000 to £100,000, is to be achieved.

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APPENDIX 1: PROFILES - INTER-INSTITUTIONAL COLLABORATIVE PROJECTS

Title: Inter University Biology Teaching Project

Period Funded. 1969 - 1974

Approx. total cost.* £ 93,400

Est. cost at 1976 prices.** £ 198,000

Initial Participants. Bath University, Birmingham University, Glasgow University, Chelsea College for Science Education, Sussex University and Queen Elizabeth College.

Original Aims. To assist in overcoming problems stemming from an increase in student numbers and the wide variations in students' background knowledge following changes in school curriculum.

Activities and 'output' so far. Production of self instructional modular materials: 'bridge courses' (to span gaps in knowledge), 'technique courses' (to avoid the necessity of repeated demonstrations) and 'main courses' in some basic topics. Trials in various institutions. Materials by Sussex and Glasgow now, or shortly to be, published commercially.

Title: Higher Education Learning Project (Physics)

Period Funded. 1972 - 1976

Approx. total cost £ 57,000

Estimated cost at 1976 prices. £ 92,000

Initial Participants. Birmingham University, Birkbeck College, Chelsea College for Science Education, Liverpool Polytechnic, Royal Holloway College, Sussex University, Warwick University.

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* These have to be approximate because the funding of all projects is not yet complete.

** Calculations using price indices from Department of Employment Gazette Feb. 1976, (Table 132) applied to payments made at various dates during funding period. These must be treated as only rough estimates.

Original Aims. The improvement of teaching and learning in Physics. Investigation of developments (actual or possible) in laboratory work, self-paced learning, tutorials and projects. Encouraging new ideas and schemes and evaluating outcomes.

Activities and 'output' so far. Production of teaching and learning materials. Trials in a wide range of institutions. A series of workshops on teaching and learning topics. Books on self study methods, tutorial work and student motivation to be published shortly. Newsletter circulated.

Title: **Physics Interface Project**

Period funded. 1970 - 1977

Approx. total cost £ 69,000

Est. cost at 1976 prices £ 110,000

Initial Participants. Birmingham University, Chelsea College for Science Education, University College Cardiff, Keele University, Surrey University, York University.

Original aims. At least 16 diferent A level syllabi bring students with a wide variety of backgrounds and knowledge to university and this creates difficulties for teachers in providing courses suited to their needs and varying levels of ability. The project aims to assist in solving these problems.

Activities and 'output' so far. Production of diagnostic tests in maths, electricity, etc. Production of self teaching units (largely programme sequences using written texts) to bridge gaps in knowledge. Trials in various institutions. All materials will have been published by University College Cardiff Press by the beginning of 1977.

Title: **General Education in Engineering**

Period funded. 1973 - 1976

Approx. total cost. £ 58,000.

Est. cost at 1976 prices. £ 82,000

Initial Participants. Aston, Bath, Birmingham, Exeter, Liverpool, Newcastle, Nottingham, Oxford and Warwick Universities and Oxford and Portsmouth Polytechnics.

Original Aims. To assist engineering education to become more effective in bringing about the personal development of students, more responsive to the needs of society and more competent in its approach to professional responsibility.

Activities and 'output' so far. Production of teaching and learning materials related to the themes 'Enterprise', 'The Engineer, Professionalism and Society' and 'Designing Work'. Creation of a scheme (Urban Crisis 2000) to encourage and support student project work related to urban social problems. Series of workshops to promote activities. Newsletter circulated.

Title: **Science in its Social Context**

Period funded 1973 - 1977

Approx. total cost £ 45,000.

Est. cost at 1976 prices £ 70,000

Initial Participants. Aston, Edinburgh, Leeds, Leicester, Manchester, Stirling, Surrey and Sussex Universities and Middlesex Polytechnic.

Original aims. To assist lecturers in preparing of teachers' and students' texts concerned with the above; the booklets cover such topics as 'Sociology of Science', 'Science and the Environment', 'Limits to Growth' etc. Trials in various institutions. Texts produced by small printing unit: 17 available, so far, and about 30 more planned. Training scheme for teachers proposed.

Title: **Joint University Genetics Course**

Period funded. 1973 - 1976

Approx. total cost. £ 88,000

Est. cost at 1976 prices £ 120,000

Initial Participants. Birmingham University, Hull University, Open University, Sussex University,

York University.

Original aims. The development of a new Genetics programme (at the second year level) bringing together the experience of The Open University in course development and the subject matter expertise of the contributing Universities: the course materials to be adaptable for use in existing Universities, Polytechnics and Colleges for full-time students as well as for students following OU courses.

Activities and 'output' so far. Devoted to the production of booklets and accompanying radio programmes and television films. These will become generally available this year.

The Higher Education Learning Project (Physics)

PJ Black

The HELP project started when physics staff in six universities and one polytechnic talked with one another about how they might work together to improve their teaching and decided to make a joint approach to the Nuffield Foundation. The application for support discussed several areas in which useful collaborative work might be done but also proposed that the choice of specific lines of development would be one of the first collaborative tasks. Whilst the details were, to this extent, vague, the underlying principles were clear: the group wished to study and develop aspects of teaching and learning physics which would meet two aims:

(a) to improve the communication and understanding between learner and teacher

(b) to enhance the responsibility of the learner for his own work.

Commitment to these implied that the project would concentrate on developing new methods and on improving understanding. Design and dissemination of teaching materials would only feature insofar as they were necessary for achieving the main aims.

The method of working of the project has passed through several changes. A consultative committee has met at least annually to review progress and has given both useful advice and practical support. The project has had a co-ordinator on half-time secondment - Jon Ogborn - throughout its development. However, these were the only administrative features that were rigidly planned at the outset - the rest was invented and then modified as the needs arose.

In a first phase, a series of meetings was held at monthly intervals, each being residential and

extending over at least 24 hours. A typical meeting would take one idea or theme, eg tutorial teaching, and discuss it at length: the time available allowed participants to unburden themselves of all their views and experiences, and to go on to start thinking together. Invitations to these meetings were on an open basis: an attempt was made to involve different people from the participating departments for different themes, and staff with interest and special experience from other departments were also invited so that the network of contacts was expanded. The outcome of this stage was that at the end of about a year, having explored many possibilities, the group selected four main lines of work and decided how to advertise posts and allocate staff to tasks and to places of work.

There followed a rather uneasy transition: with hindsight it can be said that the project having accelerated very successfully along the runway, was now trying to master the very different business of gaining height when airborne. The outcome was that the project split into four working groups, meeting independently and usually for one-day meetings, each concerned with one of the lines of work. The membership overlapped and those involved could belong to several or to only one group. It was indeed the need to allow independence to the groups and to permit multiple membership that led to the split at this stage. However each group still had members from several institutions.

At this stage the 'open-door' policy of the initial phase was continued - the project would pay the expenses of anyone with a serious interest who wanted to come along and take part in the work. This had an effect - membership expanded and the individuals in the groups were drawn as frequently from departments not involved in the original application as from those that were. At the same time, an executive was formed to work with the co-ordinator in relating the work of the groups and in taking decisions about priorities and finance.

The status of those involved and the degree of their commitment are important features of a project of this type. It was keenly felt at the outset that commitment should be initiated with and by those who wished to give time to the work, and this feature has been retained throughout. It was of course essential that the involvement of each of the departments who were party to the original application be fully

agreed within those departments: this was secured by the interested staff in each of them and in addition the heads of the participant departments were all members of the Consultative Committee.

It is difficult to go beyond this and describe the way in which lecturers have been involved in the project because of the variety. One may have come to one or two meetings, and contributed by talking about some special feature of his own teaching, and then had no further contact except to ask a more committed colleague about the progress. Another may have taken on a new method of teaching which he learnt about in project meetings, so that he began to take a small lead in work in his own department and fed back some information in project meetings. Yet another may have attended most of the project meetings in the first stage, contributed actively to two of its working groups at the later stages, initiated several teaching changes as a result and may have written one or more contributions for the forthcoming publications. Beyond this there were the staff committed by part-time secondment or full-time employment. Project funds have been used to support part-time secondment for four staff, for full-time employment of two and for full support of one doctorate student.

Thus in the course of its work each group developed a core, of the employed or seconded staff and one or two others, on whom the main progress of the work came to depend, together with an outer envelope of members who contributed usefully but whose commitment was limited. This polarisation has been accentuated in the closing stages of the work as effort concentrates on writing the books which will form an important part of the project's output.

Further features of the pattern of work can only be described by discussing the four different tasks. The first of these was a study of small group teaching. After a general consideration of many features of tutorial teaching, the interest first focussed on prepared materials which would provide an outline of something definite for a tutor to work on with his group. The first collection of these was for use in a new method of operating groups concerned with systematic work on component skills. In these 'skill sessions', four sub-groups each with about four students would work independently on pre-arranged tasks for about half an hour and each sub-group would then report its work to the group as a whole so that all could take part in an ensuing discussion. Some

of the group's initial momentum derived from having a defined novelty to try out and propagate, together with a collection of materials (the pre-arranged tasks selected to focus on component skills) some of which had already been tried and to which all could contribute their own new ideas. The portfolio of 'Skill Sessions' was a tangible asset. It was soon followed by a portfolio of prepared outlines for the more conventional tutorial - called 'Tutorkit'; some contributed to this from their past experience, others put in ideas from their own imagination, usually followed quickly by results of their own trial runs.

With both these products in hand, an attempt was made to move into the task of diffusion by inviting a set of departments, having little or no contact with the project, to each send one or two staff to a two-day residential training meeting. The commitment to this meeting was a stimulus to develop the study of other aspects of work on small group teaching - in particular, of the problems of coping with the personal interchange and providing the management which are encountered in all tutorials whether conducted with prepared ideas and materials or not. In the event, this first training meeting was of value to the newcomers because of the prepared materials and to the project because it made clear the deficiencies in other aspects of their work. In particular it emerged that generalisations about group processes were not acceptable to physicists and that useful work could only develop by analysing evidence from real physics tutorials. Some of the lecturers first contacted through this meeting subsequently helped in the collection and analysis of this evidence so that this early 'diffusion' meeting, which at one time looked like being premature, eventually turned out to be a productive part of the development of the work. The group's views were thereby altered towards a more comprehensive view of several ways in which they might help physicists with small group teaching.

A second training meeting, recruiting participants by invitations to departments as for the first, was held about a year later. Whilst this was able to achieve more than the first in that the project had better ways of attacking some of the issues it, still served, like the first, to stimulate further thoughts about obstacles to the main aim - that of producing evidence, ideas and materials which would attract serious attention from physics tutors and repay that attention by helping them to do a better job.

The group has subsequently focussed on the preparation of a book in which evidence about physics tutorials, general analyses of such matters as aims, group interactions, language problems and styles of questioning, and ideas about and collections of prepared materials will be welded together to form a guide for the physics tutor in higher education. In this last stage, only those prepared to write sections of a book could really contribute, so that the group has narrowed in membership to five co-authors.

The second group, concerned with individual learning methods, started, like the first, with the experience of one of the participants in teaching in a novel way; ie using the Keller plan. The emphasis on mastery and on self-pacing made this method appear to fit naturally with some of the main aims of the project. For this group the commitment was more definite: those involved were all sooner or later to teach a course by Keller plan. Since this is not an endeavour that can be taken on lightly, the group had an important function in supporting innovations by providing a forum for exchange, of experience and of mutual guidance and comfort.

In some cases the support was direct and tangible, in that the materials developed for a Keller course were taken over for use in a course in another department on the same topic. In others they were less direct but equally important - for example in helping the innovator to foresee some of the resources he would need to make a course viable. In all cases, help was also provided in evaluation by visits from the research student who acted as an external evaluator for many of the courses. This group again, after its first successful round of Keller courses, organised a training course, with invitations to departments not previously involved; this course helped the group to review its progress and methods.

The main effort in the closing stages is again concentrated on a book. For this, it became apparent that one strength of the group was the wide variety of ways in which the original idea of Keller plan had been adapted to fit into a variety of contexts. So one important part of the book is to be a set of case studies and the group has centred much of its work in specifying, producing, criticising and rewriting these case studies. The book is also to contain systematic accounts of several general features. The debate about the drafts of these has been partly an exploration and development of the group's thinking,

as well as a debate about style for presenting ideas and insights.

Both of these groups had in common a progression from a tangible product near the beginning to a broader perspective and to a focussing of attention on the task of getting ideas written up at the end. The group studying laboratory work has made slower progress. This is partly because laboratory teaching is less flexible: an innovation often has wider implications - requiring, for example, changes in timetable and purchase of equipment - than changes in other areas so that more consultation and the agreement of more colleagues is required. Thus although there has been thought about, and devotion of resources to, support of some new developments these have of necessity been confined to one or two institutions.

It has been more clear and at an earlier stage that the main task is to survey and analyse the problems. In fact, in university physics teaching there have been many innovations in laboratory work in the last decade: there is no lack of different and planned systems to study and compare, and the group has been able to locate several departments in which interesting changes have been made. The slower initial progress of this group may be due to the lack of a tangible innovation to pursue (as in Keller plan) or at least of a component idea to write up and carry home (as in Skill Sessions and Tutorkit) so that it had no option but to start on the more difficult tasks of analysis with which all three groups have eventually had to grapply in order to put their work into a deeper perspective.

In the event, the group did decide to make a special study of laboratory projects which form an important part of undergraduate physics courses, particularly in the final undergraduate year. However, the early progress of this study illustrated the more general problem of the complexity of such studies. Put briefly, there is too much information readily accessible, much that may be of importance that is hard to obtain, and no clear paradigm or model for selecting data or guiding inquiries: we did not know what questions to ask. This general problem partly explains why many discussions did not yield a general plan of enquiry or analysis for the rest (non-project) part of laboratory work until a comparatively late stage.

The other part of the explanation lies in the overlap

of membership of the groups which meant that the total load of work, on the co-ordinator and on others, was such that an area in which development was slow could not be given the extra attention, eg by more discussion meetings, that was needed to accelerate its progress, without detriment to the other areas. In the event, work in this area was held back and an extension grant obtained to enable it to be further pursued after active development work had ceased in the other areas. The work on laboratories is thus still in progress. It is planned that it lead to publication of a book containing case studies and analyses, but no diffusion/training meeting has yet been held.

The fourth and final area of work has a different character again. The early project meetings discussed an idea, first proposed by the co-ordinator, for a study of student motivation by means of a series of extensive but open-ended interviews. It was agreed that such a study could make an essential contribution to the project's aims. For example, the difficult task of identifying and understanding the problems of learning physics that were of importance to a student trying to contribute in a group, or trying to work on his own with a Keller unit, or struggling with a laboratory project, might be aided if we had better information about the ways in which students regard the experience of these and other parts of their work in learning physics.

The group working on this study had a fairly well-defined task and proceeded very like a research group. After initial planning, a few pilot interviews were undertaken: all that was needed for these was the co-operation, in arrangements to contact students in several departments, which the project's own network could provide, and some expertise in conducting open interviews which was provided by involving a psychologist in the group's work. Study of pilot interviews confirmed the value of the original idea and a plan for conducting interviews in a range of departments, over all three years of an undergraduate course, was drawn up. This programme required a small team of trained interviewers and a short training course was held for those who felt able to give some time to the work. After this, an interviewing schedule was organised, involving several departments outside the original project membership as well as those inside it. The collection of interview data as tape recordings, has been followed by transcription and analysis. The analysis is a research task in which an interested group can

contribute by commenting on proposed methods and interim results but for which initiative must be left in the hands of one or two people who can be fully absorbed in the data and in the daunting task of selecting ways of handling it.

However, although it has taken some time to achieve definite progress with this task, the interim results of the study have been of great value in feeding the work of the other three groups with evidence from interviews in which students chose to talk about their learning experiences in, for example, tutorials.

In this area of work there has been no need for 'diffusion' or training, and involvement of project members was needed to provide criticism, and ideas for planning the work, and manpower for carrying it out, rather than from a deeper need to construct the development in and through the teaching experience in the departments involved.

These accounts should show how the pattern of work has been determined by the nature of the problem tackled and by the particular line of development that the group concerned has chosen to follow. The balance between innovating to promote new developments and studying, without intervention, in order to understand, has emerged as an important variable. It has ranged from strong emphasis on carrying out a defined innovation in the Keller plan work, to the research study of the motivation interviews. It also has interesting nuances, one of which is the importance for those involved of having a definite product or activity at an early stage to maintain momentum whilst the struggle with the less tangible issues is resolved.

Another general feature has been the open and deliberately loose style of organisation. The reader may well be confused about the way in which the project was organised as a result of the description given above. This is no accident. For example, it has never been possible to say with precision who actually belonged to, or were 'members' of, the project. No one department has had sole responsibility for an area of the project's work. There has been no bureaucratic process whereby a decision taken in the project has been referred back to all the participant departments for ratification. One advantage of the informality is that time and effort has not been spent on the complex administrative procedures that a formally designed inter-departmental

collaboration could have erected. The links have depended on the commitment to the work of those involved and no one has had a purely bureaucratic role divorced from an active involvement in the work itself. It is too early to assess many of the consequences of working in this way. It is possible to say that it has made it easy to incorporate in the project anyone who had something to say or something that they wanted to do or take a part in, and this feature has been a distinct advantage.

A third general feature is that the co-operative nature of the project has meant that each group has been able to draw on a wider range of experience and opinions than any one institution could have supplied. However, for this aspect to be productive it is essential that there be close and direct contact between those who have new ideas or good criticism of the ideas of others and those who might benefit by revising their methods or adopting and adapting new methods for themselves. In any teaching endeavour the detail is all important and the loss of detail which could occur through indirect bureaucratic procedures could have nullified many of the advantages of co-operation. However, one consequence of this direct network between staff in different departments is the possibility of tension within a department in that those not involved in the project may feel that some aspects of the department's teaching are being organised from outside it. Of course, in collaboration of this sort not all advantages lie with the wider group; ideas are often held up and some may feel that they could work faster if there were fewer taking part so that the demands for consensus were less stringent.

A fourth general feature is the project's way of tackling the need to communicate the results of its work to teachers in higher education, particularly, but not exclusively, those involved in teaching physics. The open style of working has meant that a range of interested staff are already aware of the work. The three training meetings held by two of the groups have also served as part of the diffusion process. The project members intend to hold further meetings of this type when publications appear. The project's work was also discussed at an annual conference of the Institute of Physics Education Group which was devoted entirely to HELP. Thus a group of interested and informed physicists has been built up. Some of these having already derived benefit from its work, will go on doing so and may also spread the benefit further by, for example,

their own participation in staff training. Others are primed to obtain and use the publications as soon as they appear. The published output will consist of four short books, one on each of the four main areas of work. It is believed that these books will make an original and substantial contribution to the resources available to university teachers, particularly, but not exclusively, those teaching physics. However, it will not be easy to ensure that such books are taken seriously by those who could benefit from them and in this respect the large number of departments in which at least one individual staff member has had some contact with the project is the best hope for diffusion in the future.

This paper cannot really provide an answer to the question of whether the money invested in the project could have been better used elsewhere. One obvious reason is that a consideration of alternative ways of using the money is outside the scope of the paper. A second reason is that any judgement of the value of the investment depends largely on judgement about the quality of the output - on whether the ways in which the teachers have been changed by their contact with the project are judged to be helpful ways, and on whether the books produced say valuable and useful things to teachers in higher education. Those in the project feel that the quality is as high as they hoped at the outset and that the project's efforts will be of value in the area which is of fundamental importance in teaching, that is, in the aim of changing the perceptions, attitudes, and confidence of teachers.

Educational Policy in Denmark and its Effects on Course Planning and Teaching Methods in Higher Education

Joan Conrad

Introduction

Our interest in the 'efficiency' of educational systems has led to a field of research common to economics and to education - the economics of education. But we do not yet seem to be in a position where a real marriage of disciplines has taken place, and we find ourselves riven by the conflicting terminologies of their frames of reference.

In most western societies the present strained economic situation requires that the educational system be managed in an efficient way. It is possible however to interpret the concept of efficiency differently according to political inclination or commitment to some theory - either of economics or of education. What seems fitting for increasing efficiency from one point of view can reduce efficiency from another point of view.

In Denmark the management of higher education changed radically during the 60s; but in the 70s, society through its planning committees is making demands which seem to be manifestations of new radical changes in the opposite direction.

Increasingly teachers must live up to norms or ideals of excellence known from the field of industry, like 'efficiency' and 'rationalization', as kinds of extrinsic aim for their teaching activities; but they must not forget that the primary goals of the students in the universities are still the extension of knowledge and the development of critical attitudes. Although these ideals and these aims are not mutually exclusive, conflicts seem to be unavoidable. High level decisions about the management of higher education may very well be promoting the primary

purpose of university teaching; but in the following I will show how these high level decisions in relation to universities in Denmark have affected educational planning, course planning, teaching methods, and student-teacher relations. Although Denmark is a small country, and its problems consequently are small, the proposals from our committees are not different in principle from those of similar committees in other countries; although of course the arguments for changes are modified by regional and cultural conditions.

General Educational Policy in Denmark

The development of a modern industrial society calls for extensive changes in the qualifications of the labour force, in that the industrial development of a country goes hand-in-hand with its educational development. This relation between Industries and Education was stressed at the Washington Conference of OECD, 1961 [1]. Awareness of this relation was the original cause of a general extension of higher education in Denmark, too, in the past two decades. Notwithstanding this general awareness, politicians, economists and teachers seem to lack a shared and integrated conception of the development of society, and consequently of the development of the system of education, including higher education.

In Denmark an extensive debate on the problems of higher education took place from the middle of the 60s, as it became generally recognised that the whole system of further education, comprising both academic and non-academic studies, should be reorganised. In furtherance of this debate the idea behind our university centres took shape. We created three, the one in Roskilde (RUC) being perhaps the only one well known outside Denmark. The idea behind these centres was that academic as well as non-academic studies of different length, aimed at different occupations, should take place in one institution. The main objective of this change of organisation was to provide better conditions for meeting the requirements and abilities of the students, as they develop during their studies. The system of education itself was to become more flexible and therefore more able to meet the rather differentiated and changing needs for professional skills in society, by breaking down the traditional barriers between isolated institutions within the university, and between institutions within and outside the universities.

A new Act on administration of institutions of higher education passed in 1973 was an important result of these discussions.

This Act fundamentally changed the formal privilege of the professors to take decisions in matters concerning the institution as a whole. The Act is based on democratic ideas of the equality of *all* members to whom decisions apply in the decision-making process. And the members are *all* the teachers, *all* students, and *all* the technical-administrative staff. I will give an outline of the Act at a later point in this paper.

In the decades of expansion further education had the greatest increase compared with other areas of education.

In Denmark 'Further Education' means those studies in higher education which are normally finished with a 'candidate' degree (PhD) after 6 - 8 years' studies, and the studies at some polytechnics and teacher training colleges, where the students finish with an examination after 3 - 4 years. These kinds of education take for granted 12 years in school and the Danish 'Examen Artium' (like the German 'Abitur') or an equivalent examination.

The intake to our upper secondary schools is still increasing, but although the system of further education in 1977 will be enlarged to admit 32% of a year's total number of births it will not be enough. The result will be additional pressure on the higher education system, in particular on the universities, because it is a traditional right in Denmark that anyone who has passed the Examen Artium can enrol in any of the faculties at the universities. It should be mentioned that all higher education in Denmark is free, and grants are given to a certain extent.

In the 70s the main problem has been to restore the balance in the educational system, and new committees have been established for this. Stimulated by the current economic recession in Denmark, there is a growing animosity against the educational sector especially the universities, by the public and among politicians. In Denmark, the only political agreement possible with regard to higher education has turned out to be on the issue of reducing resources of all forms of higher education while at the same time extending the resources of basic vocational training. Although the number of students at our

universities is expected to rise from 48,000 in 1975 to 64,000 in 1979, (ie about 30%) the resources will be stabilised in the whole period [2]. Cuts in budgets, cuts in length of studies, more control of the studies, more control of the work of the students, and restricted admission are the most frequent proposals now in 1975/76 to 'improve' the educational system. These economically imposed conditions will determine the structure of higher education at all levels.

In the 60s ideas such as democratic organisation, humanism, and the full participation of individuals in social institutions and in decision-making, influenced the debate. Now efficiency, benefits and costs are the most central concepts.

Although economists maintain that the new demand of 'efficiency' is 'nothing but' a question of allocation of resources, at the same time they define the need of resources as a function of the following factors: access, period of study, and costs per student [3]. It is obvious that these economic criteria intervene in the tradionally pedagogical domain.

For the teachers the problem is: to what extent is it possible to modify the internal qualities of teaching, that is, the contents of the subjects, the shape of curricula and teaching methods, without changing the study as a whole fundamentally?

This dilemma is not only the teachers', of course, it is the students' too. Nevertheless, the teacher's avocation (as one who professes a particular subject) is clearly affected.

In order to understand this dilemma, and to understand the effects of conflicting points of view on the management of these institutions I will give an outline of our present Act; following that, I will describe the development in a specific subject.

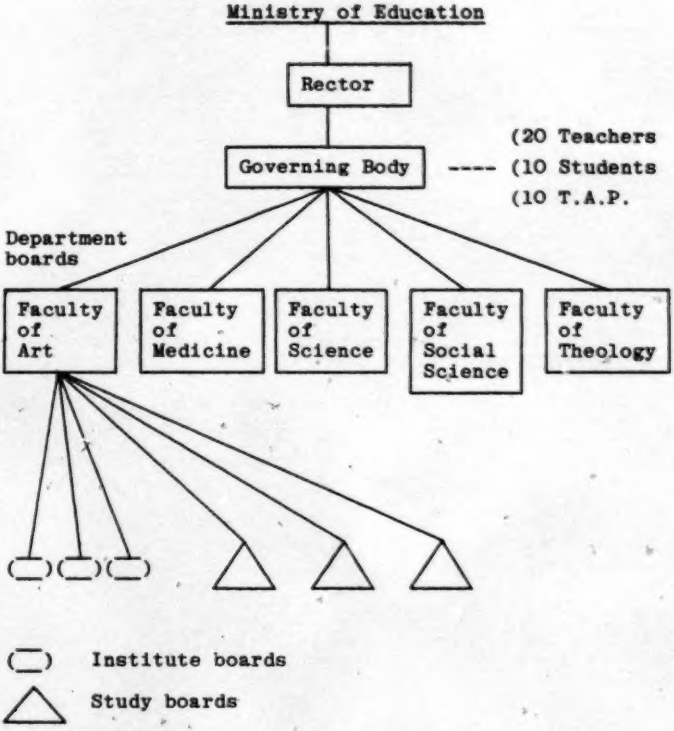
Act on Administration of Institutions of Higher Education [4]

The Ministry of Education is the supreme authority of the Institutions covered by the Act. The management of each institution is in the hands of the rector or vice-chancellor in conjunction with the governing body (konsistorium), the Councils, Institute Councils,

and Study Boards, the latter for educational (academic) activities.

The rector and the prorector are elected for respectively 3 and 2 years at a time from among the professors, associate professors and full-time lecturers of the institution. The members of all bodies are elected. The total number of members of the Governing Body at The University of Copenhagen, for example, is 40 - 20 teachers, 10 students and 10 technical/admin staff. (The total number of students at the university is about 30,000.)

The Governing Body is the highest (collegiate) committee of the institution and takes decisions in all matters concerning the institution as a whole.



Education and research at an institution takes place within Main Departments or Faculties (for instance medicine, theology). The Administration of each Faculty is the responsibility of a faculty board, elected according to the same principles as the Governing Body. Research activities in each subject area will normally be carried out in institutes, and the institute will be managed by an Institute Board. What we are here most concerned with is the *Study Boards*, which are established for groups of subjects, for subjects, for lines of study, or for parts of a subject.

The Study Boards consist of an equal number of teachers and students. The members are elected by and from among the teachers and the students within the area of the Study Board. The Study Board *decides* matters regarding the contents of courses, organisation of instruction and examinations, appointment of instruction assistants and corresponding levels of teachers, and they have an opportunity to *state their opinion* regarding the establishment or abolition of teaching posts (professorships, lectorships) and matters concerning the educational qualifications of applicants to such posts. The Study Board has a right to state an opinion on other matters concerning instruction within the area of the board. *Decisions concerning substance and form are in this way placed with the Study Board.* Thus the results of the discussion in these boards may be said to lead to a redefinition of individual subjects. The Act has had a direct effect on the subject-content of courses, on the form of the examinations, and on the style of instruction as well.

The most radical changes have occurred in subjects under the Faculty of Arts, where it is perhaps easier for political interests and theoretical fundamentals to manifest themselves. I will give a specific example, namely, the study of Danish Philology (language and literature). As mentioned before, study at the universities leads to a 'candidate degree' (roughly equivalent to a PhD). It is a professional degree insofar as it satisfies the requirements for obtaining a teaching position in the 'Gymnasium' or Secondary School, and it qualifies the student for a scientific or scholarly career. There are about 2000 students in this subject at the University of Copenhagen. The Study Board is elected for 1 year, it has 4 staff and students, who elect a staff and a student chairman for 6 months each.

The Development within the Study of Danish Philology

The basis of the study of Danish Philology was originally an ideological one, insofar as its aim was to grasp and express the notion, or rather, the spirit of Danish nationality. This was supposed to manifest itself most concisely in the language, and consequently in the literature, of the nation.

Such an idealistic notion as Danish nationality, has perhaps only existed in those rather limited classes of the community from whom university staff were usually recruited up to about the 1960s.

Even after the undergraduate and the professors came to be recruited from less narrow and culturally less homogenous classes of the community, this notion of Danish nationality still had a deciding influence upon the practical elaboration of the subject.

It is fair to suggest that the way the subject was handled had become, by the 1960s, a hollow tradition, which had quite lost touch with the original ideological rationale developed in the 19th century.

When, in the late 1960s, student numbers rose dramatically and the basis of recruitment was extended more and more to the 'lower' classes of society, that tradition could not longer be maintained. The relevance of all the constituent disciplines was called in question, and even the justification of the texts usually studied. Fundamentally it was a question of what should be the basis and social relevance of the subject. For example, the favoured texts for analysis were changed from the traditional poetic ones to journalistic writings. These questions and doubts led to a political struggle in the subject. As no reconciliation was possible, and as none of the parties involved could win a decisive victory, the result was a kind of armed neutrality.

Before 1969 the traditional courses were chosen by the Head of the Department, on his own authority, and were compulsory - not only for the students but for his junior colleagues on the academic staff. The course elements were defined by nothing more than a title in most cases.

After 1969 the whole picture changed, and in the most radical and far-reaching manner. The course in Danish Philology was now defined by the Study Board and now came to represent a complex of options which

took roughly the following form: There were 13 sub-disciplines, from which a student would choose 5. Each sub-discipline was *further* sub-divided into course elements - sometimes just two or three, but in some cases six or seven. Each of these course elements was the responsibility of one teacher. He had an overall guideline from the Study Board as to what the course was about, but he could further define his approach so that the final package of course elements making up the sub-disciplines could consist of quite different - even mutually incompatible - elements. The student opting for the 5 out of 13 sub-disciplines was also free to opt within each of the five sub-disciplines - for instance, he could, if he so wished, choose course elements known to be biassed ideologically, ie Marxist, or Existentialist, or whatever other 'ism' would be currently on offer. Of course, a student could also be quite eclectic, if he so desired. Or perhaps he might get sick of the Marxist approach after 2 years, and henceforth choose only teachers with known Christian principles. In other words, a remarkable degree of choice and option came to be available. On the basis of a combination of ideological conviction and professional interest, you choose the disciplines you need and the treatment you prefer.

The change from an authoritarian system, where only the professor made the decisions, to a more democratic system has naturally affected course structures; the very idea of 'correct', or 'objective' knowledge has become the subject of energetic debate. As a matter of course, lecturing is now regarded as an authoritarian way of instruction. In the faculty of arts lectures by professors are rather unusual nowadays. Mostly the instruction takes place in small groups, where the role of the teacher is much more that of a counsellor than that of a 'master' or 'instructor'.

Under these circumstances it is inappropriate to draw up specific requirements for examination in the branches of knowledge grouped in the Faculty of Arts. Student and teacher decide together the requirements, essay titles and methodological procedures. Most of the work submitted is double marked by an external examiner. This replaces the examination system.

It is rather hard to see how the concept of 'efficiency' could be applied in this sort of situation.

'Rationalisation' and 'Mechanisation' of Education

Finally I will illustrate this conflict with an example from a totally different field, because I do not want to give the impression that these problems are only relevant to the Faculty of Arts.

In the study of medicine there are two different concepts or models of the patient. In one of them - the organ-system-defect-model - the patient is looked upon as a system of organs in a state which can be described as defective or diseased. In the other one - the dynamic model - a patient is characterised as a sick person, and the position of the patient in society, in his family, on his job, and the interaction of all these circumstances are included.
Clinical practice will vary, depending on which underlying theoretical model is accepted.

In the first case the patient will primarily be considered as a natural object, where technical interventions are possible. In the second case the patient is also a subject placed in a system of circumstances, and it is necessary to be aware of this fact in the treatment. The biological - scientific side of the situation is only part of a greater totality.

In the first case as well as in the second the purpose of the treatment is to cure and to prevent disease, but the relation between the curative element and the preventive element is different.

On the basis of the dynamic model there will be a gradual transition from diagnosing to explaining the cause of a disease, and then to a critical attitude toward fundamental social conditions, including work conditions.

Now clearly, the planning of the basic training of these two types of doctor will be different. What kind of doctors we really want, or what the proportions of a 'mixed type' should be, is not the problem here. The point is that it is *much* more easy to formalise the contents of a study plan which favours type one, based on the organ-system-defect-model. From an economic point of view it could be an effective and rational study plan.

We might suppose that economically imposed conditions will increasingly necessitate a study plan which favours type one. From a simplified economic point of view it will be the most effective study plan.

But who should have the right to make decisions about what sort of doctors we want?

Conclusion

Our present law on university administration confirmed the traditional autonomy of these institutions, but the new demands of efficiency mean a restriction of this autonomy, and the new rationalisation proposals can be seen as a limitation of the traditional area of competence both of teachers and students.

In our situation today it seems reasonable to propose more control of studies, more control of the work of students, and more use of educational - or instructional - technology as tools well fitted to making the educational system more efficient. This demand for 'efficiency' has a restrictive influence on the teaching-learning process, just like demands for 'rationalization', 'democracy' and 'critical attitudes'. From these demands or normative concepts (ie ideas of excellence) the standards for evaluation of the pedagogical efforts are inferred. These standards refer directly to an authority, which can intervene with sanctions or punishment if the standards are not aimed at or followed. In that way the standards determine the teaching-learning process.

All the normative concepts mentioned above have a restrictive influence on the teaching-learning process in higher education to-day, but they do not have the same status. Their strength depends on the possibility of inferring standards or criteria for evaluation.

Aims or objectives of higher education are mostly described with normative concepts from a humanistic pedagogy, but aims like 'democracy' and 'critical attitudes' may be illusions as long as we only accept standards inferred from normative concepts based on other points of view only.

In order to create a better dialogue between teachers and economists with due regard to educational values as well as economic considerations, teachers must realise the pedagogical consequences of all higher-level decisions. They must develop arguments for a new kind of 'efficiency' based on the pedagogical situation, and especially on matters concerning the individual disciplines and the teaching-learning process.

At the same time economists, politicians and educational technologists as well might at last begin to realise that the demands of 'efficiency' will change the internal structure of any academic study. In the last analysis, all judgements of efficiency are teleological, ie they relate to some end, or aim, or objective. But are not universities the institutions which want to maintain a critical attitude to *all* ends or objectives..?

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Efficient Teaching: A View From the Higher Education System

Tyrrell Burgess

It takes some courage to have a conference on efficiency in higher education. This is partly because of a difficulty mentioned in some of the papers we have received. Educators and economists differ fundamentally about the concept itself. When educators talk of improving staff/student ratios they mean more staff. Economists regard this as deterioration. Educators, like professional associations, believe that improvement follows a lengthening of courses and the move from part-time to full-time study: to an economist this is a loss of efficiency. Educators believe that cuts in educational expenditure will lead to the inevitable deterioration of the service and should thus be resisted: economists welcome this lower expenditure. Educators tend to believe that innovation is possible only with expansion: economists would hold that innovation is essential with contraction. Efficiency, then, is deplorable to the educator and desirable to the economist.

I believe that economists are partly to blame for this. They have concentrated on costs per place or costs per enrolled student. The classic example of this in Britain is the DES Planning Paper No 1 on output budgetting, but the practice is not absent from some of the contributions to this conference. But this is to confuse input and output. Education is a 'process industry': its inputs are labour (teachers), capital (building) and raw materials (uneducated students): its output is educated students. If we are to talk of efficiency we have to talk of the quality of the output.

At this point economists fail us utterly: they are unable to say anything about the quality of output. A number of them have thought to measure this quality

in terms of the salaries which graduates receive, but these salaries are in no sense a return to the education system, and it is notoriously difficult to attribute any particular part of them to education. If we wish to talk of efficiency, we have to look at the difference which is made to students by their education in educational, not economic terms.

But here the educators fail us too. Their methods of assessment do not enable us to judge quality in these terms. Most examinations test their low level skills, like isolated recall, and their results are not comparable with those for tests taken earlier. Perhaps this is as well. I believe that low level skills are well demanded, displayed and tested at 'A' level. I guess that they will have deteriorated by graduation and that there is nothing measurable which has taken their place. The joy of this assertion is that it is uncheckable in present circumstances. Our assessment procedures are astonishingly circular: we set examinations: people prepare for them, and we can tell whether they have successfully prepared or not. This has little to do with measuring quality or the improvement of quality and it means that efficiency of teaching or learning is not measurable.

Let us look more closely at learning and at psychological explanations for it. As I understand it, there are three groups of theories: those of the Gestalt psychologists, the associationists and the functionalists. These theories have several disadvantages: they are incompatible, they are not testable and they seem largely unrelated to any of the known practices of teaching.

If we are to make progress in discussions of quality, I suggest that we will find the logic of learning more helpful than its psychology. Learning proceeds by the formulation of problems, the proposal of solutions and the testing of these solutions - a process which leads to new problems and thus to the further advance of knowledge. On this view, a course of education is a solution to some problem - personal, vocational, social or whatever the case may be. It is the problem of getting from one state of affairs to another - of turning the uneducated student into an educated one. The precise problem must be formulated at the outset. The solution proposed is the course - and our assessment procedures must test this solution. In proposing the solution (course) we can mix input (for example the staff/student ratio) and then test alternative outputs. At the School for Independent

Study at the North East London Polytechnic we are trying to work out a programme of this kind. Our students do a 2-year programme leading to a DipHE. They begin with a planning period where they formulate their own problems and gain the agreement of their tutors to a solution which becomes their two year programme. They have to say in outline at the outset how their programme is to be tested. The first students will be facing their final assessment next term. Already, however, I should like to claim that it is notably more efficient than other courses in higher education. We work at the lowest staff/student ratio in the Polytechnic: it is a 2-year, not a 3-year course: most of the students do not have the traditional 'A' level entry requirements - so we claim that the quality of our output, measured by the difference made in the student, is higher than elsewhere. Like my previous assertion, this one cannot be tested either because degree courses and results are not amenable to comparative testing either with each other or with our programme.

Can this be the reason why it is so difficult to convince educators to take seriously the idea of efficiency in higher education?

The Efficiency and Effectiveness of Knowledge

DWS Gray

Is Higher Education about knowledge? If we were to assume that it is, what would we know about knowledge that would help us to focus usefully on questions of efficiency in teaching methods? The effect of scientific knowledge, I have been taught, is ability to predict; and the implication is, where we can't predict, we can't say we know. On the other hand (we might want to insist) there are sorts of knowledge, other than scientific, which without actually endowing us with certain or at least confident prediction might give us a sensation of expectation. As they occur, events may turn out to reinforce these expectations. In such states of consciousness one has to keep a sharp eye open for contradictory evidence, and be prepared to revise one's expectations in the light of actual events. Now, was it predictable that this conference would soon find itself enmeshed in the confusion of two dimensions of meaning to the notion of 'efficiency'? At any rate, it was not predictable that so few speakers and participants would acknowledge the importance of the ambivalence - or indeed that some intrepid wielders of Occam's Razor would deny the confusion by implying that it was just an unfortunate illness that some over-complicated people suffer from. It was, therefore, a relief when Professor Goldschmid of Lausanne acknowledged the difficulty right from the start of his paper. He noted that one dimension of meaning arises from student dissatisfactions, and this refers to the *effectiveness of the teaching*; while the other dimension derives from economic constraints, and this refers to the *efficiency of the system*. But Professor Goldschmid was not going to descend into the maw of political philosophy which opened before him; he snapped it shut with a neat click: "upon further reflection, it becomes obvious that the two are interdependent: instruction which is effective, but

very costly, is inefficient; inexpensive methods which are also ineffective are also inefficient." Having thus dealt with a merely semantic problem, Professor Goldschmid got down to business with verve, with gusto and with every sign of mastery. And the business was cost-effectiveness. He set out to consider the three areas where the relation between cost and effectiveness could be bettered, viz the ability of teachers to teach, the ability of students to learn, and the ability of administrators to organise and manage institutions.

His paper lies before us, and it would be pointless to summarise what is in any case a concise summary. The points that need to be made are not to find fault with his presentation, but to develop if possible some of the implications that haunt his exposition. With everything said, things remain unsaid - things that go with what was said, but which have been left in the dark. How could we cast light over these issues for the purposes of our orientation? One of the most interesting, problematic, and contentious points of innovation that he mentioned was something that he called *peer-teaching*. Could we say that the idea of peer-teaching is class-based in more than one curious way? The source of our inertial opposition to the idea is that teachers, as an identifiable group of people, do not want their own core contribution to society to be exercised by the class of people it is directly aimed at, their own students. It interferes too basically with the fundamental order of things, it flouts the very rules by means of which the teachers have established themselves as people with something to offer to society. If students can teach each other at all, where could it end? Thin ends of wedges, and other metaphors, will rise aplenty to stick in the craw, or even other places uncomfortably near the person; dare we say, the wallet? The Academy never was an institution predicated upon equality; it has always been elitist, and in some senses at least it always will be so. Since it would be vain to try to exorcise Marx's spectre from such a discussion, we might as well admit that even in a completely communist community the Academy would still serve a vital function in identifying just who had the greater abilities from whom it would be appropriate for the community to take more. The point need not be laboured: Higher Education awards *degrees*, and these degrees differentiate between those who get them ('are admitted to the degree of ..') and those who don't. And consequences follow these differentiations.

The consequences are social: people are identified by documents called 'qualifications'. The meaning of the question 'What are you qualified for?' is probably something like 'What are you *entitled* to do now that society has tested your skills?' In our present economic circumstances a lot of graduates unable to get the jobs they are qualified for feel cheated, *robbed of an entitlement* of some kind. These entitlements are identity markers in some significant sense: the members of these classes, unable to claim the right to practise and to earn that goes with a completed training, suffer disaffections which sensitise their affiliation to the established economic structures of society; they begin to question these structures. The consequences of the differentiations are social - and political. In this context, the drive to make teaching methods more efficient is bound to have strong political components, and we must therefore acknowledge that the time has surely come to ask questions about the parties - the sides - interested in the processes which we want to make efficient. For instance, if 'peer-teaching' is the right name for the family group of innovations which huddle together under the word, what makes them belong together, and what makes 'peer-teaching' an appropriate name? As far as I can perceive, it is based on the assumption that all students, from freshman to post-doctoral, are peers (equals) because they are non-salaried, non-tenured, and not responsible for the content or intent of what is taught. Yet, because they are variously motivated and variously advanced in knowledge, they can be managed into positions where they can do some of the teacher's work for him. Efficiency here could mean delegating the duller, more routine parts of one's responsibilities to willing slaves, and it would require very little effort to depict the process in terms which would expose it as a particularly odious form of exploitation. What possible rewards could be offered to the students who would undertake these tasks? One cannot envisage the fiscal procedures of British institutions ever being flexible enough to accommodate systems of payment in actual money. The only alternative to the possibilities of exploitation would be to make some sort of teaching responsibility a required part of the course, in which all students at some time in their course would have to perform a defined range of what might be called teaching duties and tasks.

One of the virtues of this is clearly related to the psychological fact that teaching and learning are

inextricably reciprocal: more than a dialogue between different people, an internal reciprocity of response is involved. Just as the teacher needs to research, to go on learning, to revise his knowledge critically, so perhaps the learner needs to teach to consolidate his learning in critical confrontation with equals. There is, however, a disadvantage: such processes built into a course would require new sophistications of administration, control and monitoring, the development of which would be costly in time and money. (I am *not* talking about new superstructures to be built over the teacher's head.) The time element here has to include a feature which might be called 'inchoate confusion time', a natural concomitant of innovation in all spheres of co-operative action. The 'teacher', if it would be appropriate to continue calling him that, would have to develop new skills. I have experience teaching a course where Final Year students are taught only in seminars, which proceed on the basis of papers submitted in advance by students and staff (two papers by students to one by staff). The advantages of *effectiveness* have not yet been followed by advantages in *efficiency* to the extent that would count in costing calculations.

I find it tempting to think of Maxwell's Demon in this regard. J C Maxwell showed how, if a Demon could position himself at a gate between two enclosed volumes of gas, and could operate the gate to allow fast-moving molecules to collect on one side and slow-moving ones to congregate on the other, we would have a heat gradient, which differential could be exploited to produce energy. And the only 'cost' incurred would be the cost of the *power of discrimination* that the Demon has. Of course, J C Maxwell was a natural philosopher who sought to show by this logical phantasy how impossible it was to get free energy. Is there a cultural philosopher who could show us that in the metaphysics of education the contrary might be true? For 'Demon', shall we read 'teacher'? For 'fast-moving molecules' shall we read 'the high fliers'? For 'slow-moving molecules' shall we read 'the thickies'? I deliberately identify the poles by two of the most objectionable informal terms current in our professional vocabulary. I have to report again from my own experience that my Final Year Seminar could have been destroyed by a fast-moving molecule, re-inforced in all the arrogance and egotism of his assertiveness, who blights the tentative and sounder judgement of the slower moving ones. Perhaps a true Demon would open the gate and let him out.

It is not altogether idle phantasy which brings Physics into the discussion. As Leslie Wagner pointed out, the notion of efficiency derives all of its significance from the defined limits within which it is allowed to signify in physical calculations. Professor Goldschmid would surely assent to Mr Wagner's case that "if we are to measure efficiency, we must be able to identify and measure inputs and outputs and specify the relationship between them." Now, like many other teachers at the conference, I felt a surge of pleasurable agreement with Mr Tyrrell Burgess's ironic treatment of the educationalist versus economist conflict, delivered with rare sardonic panache at the end of the conference. But it remains true that the economist is not to be put down by remarks either of wit or of weight. It is, after all, a national and international economic circumstance which weighs heavily on us at the moment and for the foreseeable future. That circumstance is not susceptible to argument, however fine. Professor Goldschmid struck a finer balance than did Mr Wagner in trying to treat of the incommensurables in the equations by means of which we will identify and accommodate the factors governing our situation. The latter may have deceived both himself and us by choosing to follow Professor Harry Johnson's authority in defining the functions of Universities as fourfold, viz:

1. teaching: (does this mean 'communicating knowledge'?)
2. research: (discovering and testing knowledge?)
3. information storage: (keeping knowledge accessible?)
4. a symbol and repository of civilisation: (! ?)

Both Professor Johnson and Mr Wagner find some suitably cynical and economical ways to wrap up the notion of 'a symbol and repository of civilisation' and post it to the dead letter office of lost issues: issues lost, Mr Wagner showed he knew, only to economics. A titter ran round the hall and the touching of these points gave us quite a frisson. None could doubt Mr Wagner's sincerity in remarking "Now whilst not even an economist would argue that only that which can be measured can be valued, it is not being unduly cynical to ask why it always seems to be those things which cannot be measured which are valued most." This jibe needs to be answered in a publicly accepted language, though it would take more than a few sentences in this context to do so.

Nevertheless, I think it can be said that the 'civilisation' which may distress the economists by its incommensurability is the name of something real, even if it be a quality which defies all attempts at charting. It is not the name of a big, shapeless thing, but rather of a very large number of little events. It is the name of an element of the processes of communication which make possible the very phenomenon of community. It would not be too much to argue that the interface between teachers and learners is one of the crucial locations where the character of these fundamental transactions of community is decided - those countless confrontations between teacher and learner, the reciprocating exchanges of vastly varied range and type which transduce the messages that generate the possibility of future. These phenomena are perhaps not best identified by the word 'civilisation' nowadays, and Mr Wagner may have set up a rickety Aunt Sally to cock his shies at. No doubt it is necessary to work for a rectification of names in this area, as in many others. Professor Goldschmid could obviously not have been expected to undertake such a task, even if he had wanted to; he was, of course, committed to a comprehensive coverage of present practises in innovation. As such, he assembled and systematised some valuable and provocative ideas, without engaging in radical abstractions of what may be called the philosophical sort. A good thing too, I might think. But is it a thoroughly irrational lump of conviction and prejudice in me that wants to conceive of the teacher's task as some sort of *cultivation*?

We heard a dual presentation by Miss Lindstedt and Mr Berg from Stockholm School of Economics; even more ironically, their experimental course was part of the course in 'Organisational Theory and Personnel Administration'. The features of their course element which were most striking were all concerned with the subjective experience and development of the students. For the duration of the course, for instance, all the students had to keep a diary in which to record their personal responses, or perhaps better stated, "to hold a dialogue with himself and to constantly evaluate what took place". It was, Mr Berg said, "so hard to communicate with oneself". The diaries were monitored by the tutors, and there was considerable effort to develop 'critical intersubjectivity'. This sounds to me what I want to understand by 'cultivation'. I value it. I cannot measure it. I want to repudiate any model of Higher

Education which cannot accommodate it. I came to feel that the pervasiveness of the issues at stake was more visible in the particular local case such as this than in all the comprehensive coverage for which academic laurels are usually awarded. At the end of her valuable account, and in response to a question, Miss Lindstedt let a surprise cat out of the bag: their experimental course element had been set up while the Professor was away on sabbatical for a year in America. There was something we all recognised as a truth. While the cat's away, the mice will play. Were we all so pleased at recognising this that we were tempted not to think about it? It was such a homely truth: the relation of cat and mouse is a phenomenon known since time immemorial; it is so natural as to be worth less than a shrug. What I have in mind, however, is to use this truism to explore an aspect of our expectations which may need adjusting.

The traditional view of education sees the process as a relation between the teacher and the taught, between *one who knows*, and (a lot of) *people who don't know*. Although one might be tempted to think this an uneducated view of education, it is surprising to notice how far it permeates the system. From the point of view of Management, it is this which lies at the heart of Staff-Student Ratio, that super-reality or surreality is so important it is dignified with acronymic status as the SSR. The teacher knows, and he is the master; the students don't know: but what does that make them? I want it to be clear that I am not looking askance at Management as such, or at particular Administrators, or at any particular decisions. What I want is to clarify some issues about the status and uses of knowledge. It is a received wisdom in our circles that the highest academic virtue is associated with mastery of one's subject. I want to ask what we are committed to by accepting such a value. I am wondering about the worth of mastery, of expertise, of specialisation. I want to ask why and how mastery of a subject seems to imply mastery over people. I am wondering whether there be some shift or warp in the metaphor of mastery which makes 'master-pupil' or 'master-apprentice' relations so easily become 'master-slave' relations. Is there a sort of cat and mouse situation built into the educational enterprise? Was that why we reeled in knowing horror at the prospects opened up by Professor Joan Conrad's account of democratic reforms in the Danish Universities? Stark stupefaction was the general feeling when we heard that Danish students had such powers in the

administration and in the formulation of course content since the reforming Act of 1973. If it be true that we live in a world where the mice are out to bell the cats, the academic cats seem to have been truly belled in Denmark. If I may play, at least with my metaphor, the undermice are calling the topcats into line. One sturdy Englishman at the conference was heard to mutter: "we've known what to think about Denmark ever since Hamlet." In England, we are so confident of our political 'stability' - for which read: the permanence of our hierarchical structures - that we can afford to take such stability for granted.

What is it that we seem to be so confident of? Could it be this? We think we know, and the state pays us comfortable salaries because there is a formal social consensus certifying our knowledge. It is conceived that we must therefore be the best people - the only people? - to hand out or hand on what we know to those who aspire to know. There is, also, a traditional social consensus concerning the needs of society for this knowledge, though the consensus is now riven by dissents and competing priorities. We work a system with a characteristic operational pattern: approved knowers select aspiring knowers, communicate the received pattern of knowledge, control and test the aspiring knowers to check that they have received the knowledge, apply a standardising quantifier which grades the knowledge, and finally expel the aspirants as junior knowers from the other end of the system. Most new knowers have a binge and then scarper to the ends of the shrinking earth to begin working and learning. But a few go on the dole; and even fewer go on acquiring knowledge, being admitted to ever higher degrees until they achieve the status of Teacher.

We would want to say, I think, that we can't have confidence in a model like this. Surely this is no satisfactory account of the fundamental transactions of our concerns. To take it up in its own terms alone, we notice that it doesn't allow for a phenomenon which most of us recognise in people of real skill and achievement, namely the ever-growing sense of *not-knowing*. I felt profoundly grateful to Miss Lindstedt and Mr Berg for reminding us that authority derives from skill, or confident execution, and that the possibility of the development of skill is generated only in a particular quality of critical communication with oneself. My gratitude is the greater because I sometimes wonder whether we be still too much committed to a notion of the quantification

of knowledge not too different from a points system worthy of 'Mastermind' or 'Television Brain of Britain'. I am thinking about the efficiency, the effectiveness, the effect of knowledge- and not only of knowledge, but of experience too. I am wanting to say that the basic condition of creative development is self criticism, a form of consciousness unsusceptible to quantification and unfortunately all too susceptible to mis-representation. The quality of confident reflection that I want to promote would take as its crux an orientation to the effect that the only mastery that matters is a mastery of the self in its situation, rather than the mastery of the situation. This is important because the situation involves other people - potentially all other people. This is why J R Ravetz, in his book "Scientific Knowledge and its Social Problems", has felt constrained to argue for the development of a critical science, to counteract the power of industrialised science. Shall we view our education as an industrialised system? If we were to do so, would we need to develop a critical form of Higher Education?

The 'interdependence' that Professor Goldschmid wanted to use as a way of relating the two possible readings of the notion of 'efficiency' is real enough. It is true that inefficiency can embrace both effective and ineffective teaching. But we must go further into the relation. It does seem to fall specifically to the teachers to effect a marriage, a reconciliation of what could be seen as diametrically opposed forces. The mastery that circumstances oblige us to seek, to develop and to maintain in *our own selves* is a mastery to be exercised in a Janus-faced situation. We must face our students on one side, and face our paymasters on the other. Stuck as we seem to be with the economic analogy of consumption and production - and need I say that I detest it? - we should locate ourselves as the middle-men between the consumers (students) and the investors (taxpayers) with their board of directors (government). It is surely not only our efficiency and effectiveness that is at stake, but the possibility that what we have to communicate may be rejected. When we commit ourselves to our jobs, our vocations, and when society supports our choice to the extent of appointing us to a post, we find ourselves committed to a permanently critical activity concerned with discriminating logical necessity from the convenience of 'received' patterns and models. We do not have to believe our teachers, any more than we have to believe any other person; we enter into a critical dialogue with them. We

should expect our students to enter into a critical dialogue with each other and with us.

It is, of course, clear that critical dialogue is only possible when both sides know how to operate the rules of such discourse. We have not only seen evidence of students who do not understand this; who may even believe that the appropriate form of criticism is the 'demo', or other gestural manifestation. We also know examples, and it is perhaps more important to say this here, *in ourselves*, of the teacher's version of the same defalcation. I am thinking of those situations where we display an 'authority' treating the student as less human than ourselves - where, in short, we are less than honest. But there are two versions of this bad faith: the first is where we hide behind 'academic' frontages for non-academic purposes; the second is perhaps more prevalent and more problematic, and it is brought to mind especially by the 'peer teaching' concept in its social rather than its economic implications. We sometimes find ourselves pretending a false equality with our students disguising the social fact that we will be their judges when it comes to finals. This is a form of contempt for the role of teacher which misguides students and encourages them to have contempt for the role of student. Yet students expect grants to be paid, just as teachers expect their salaries. The possibility that these expectations may be frustrated is one which should be of startling prominence in our present minds. Social reality is both *mythical* and *actual*, which is to say: it is conventional. 'Rights' may turn out to be myths at any time. We need to be sensitive to the fragility of the web of expectations which balances the equation containing all the private egos of the community. Could it be that 'objective truth' is no other than that myth which we expect others living with us to share? 'Critical dialogue' may be the name of that discourse in which we are permanently engaged in the never-ending effort to discover what we are entitled to expect. This is 'Knowledge' that matters. This is the foundation of cultivation, irrespective of subject or discipline or research. This is the truth of community and communication that Mr Wagner was prepared to speak cynically of, deceived by Professor Johnson's model. I hope that it is obvious that I am talking in a political vein, and I am saying that the critical dialogue I have mentioned is stultified both by imperiousness and by abjection - from either side. That way lie cats and mice.

Now perhaps I am not entitled to make political statements; perhaps it is felt to be inappropriate; perhaps all the teachers at the conference would agree that politics and teaching efficiency are 'clean different things', as Charles I said about kings and subjects. I recognise that this is not the sort of statement which ordinarily counts as proper to the conventions of the kind of this conference, at least in English-speaking countries. Am I putting a pigeon among the cats? Conference participants were not sympathetic to those parts of Professor Conrad's paper where it was taken for granted that political awareness was an appropriate presence in the special communities of higher education institutions. Perhaps we hanker for the secluded clubs and officers' messes where it is the rule that one must not talk about politics or women. Alas, neither the one nor the other is prepared to be relegated any longer. It may be true that we must instead relegate to obsolescence that meaning of the word 'academic' where it is used to signify 'not real, having no effect on the real world'. We may now be the most politically engaged section of the community, and upon our effectiveness may even depend the efficiency of government.

Professor Goldschmid argued a tightly professional case, supported by comprehensive references to the voluminous literature that has recently developed in the field of research into Higher Education. A field of expertise has been established, of course; but this has drawbacks when the subject is of interest to all of us, irrespective of discipline or speciality. If academics are going to approach it at all, we will advance either with gingerly mien and trepid squint at the bibliographies, or with the brusque impatience of the practitioner out to best all clever dicks masquerading as theorists. 'Those who can, do; those who can't, teach'. If we are still stuck with this sardonic Shavian map of our moral situation, it may be because we don't altogether appreciate some of the consequences of seeing teaching as a communicational activity between human beings in actual society. We are not the pickled priests of some arcane rite. Heterodox though it may be, I want to say that teaching methods derive from teachers' attitudes; and teachers' attitudes are predicated by the system which frames them and their/our activities. Is there, for instance, a conventional wisdom of academic politics which accepts (and to some extent enforces) a systematic distinction between the 'pure' and the 'applied' forms of knowledge? Is there an appropriate correlation between the 'High Flyers' and 'pure

knowledge', etc.? Do fast moving molecules travel higher and purer? Would not pure knowledge have effects down here? Would not practical applications have effects up there? Who can afford the luxury of espousing the one to the exclusion of the other? What weird hierarchies of value are being articulated in current administrative philosophy to put into modern effect those antique neo-platonic distinctions between doers and knowers? Questions not to be asked. Shall we live to see Polytechnics and Universities re-create the recently abolished distinction between Grammar Schools and Secondary Moderns? In somebody's mind somewhere - perhaps the Divine Logos no less - will this be seen as an increase in efficiency? Or a re-establishment of the old harmony? Perhaps Maxwell's Demon is alive and well decorating the office of a Secretary of State.

Meanwhile, in the past ten years or so we have been nourishing in the dimmest recesses of our sacred groves a bunch of priests dedicated to what must surely count as the highest education of all: the teaching of teachers in Higher Education. There is surely a table-turning effect to be noticed here. The Minister responsible for Higher Education, despite his uniquely appropriate qualifications for the job, failed to note this when he was asked from the floor after his opening address, why the things now *known* as a result of research into Higher Education were not being *applied*. He did not say that, until it is applied, we won't be able to know whether we really do know it or not. He opined it was because the senior members of institutions had never had things like induction courses and because the suggestions for innovation often came from administrative quarters in the institution. He did not need, he said, to expand on the traditional distrust of the 'admin wallah'. The Right Honourable Admin Wallah-in-Chief did not mention any other reasons, perhaps because a Chief has less leeway than anybody else to break conventions; but he might have thought - I hope he did think - that teachers are less motivated by techniques of teaching, than by the *purposes* of teaching; and *they* are all political, for they cannot be identified without reference to the policy. At least he didn't say that all knowledge is convention; nor indeed, that teachers may be unteachable. But he did say, in answer to another question, that there was a neglect of research into Educational Management. Here again, one could not quite help suspecting, was the same old rub: the research done, and the results disseminated, would this new knowledge ever come to to be applied?

Effective Efficiency

David Warren Piper

The papers in the volume represent the attempts of some professional educators to improve the effectiveness of their teaching and the efficiency of the system by which they teach. Self-improvement is apt to be an emotional business. In most of us lurks the desire to be better but not different. We tend to shun the challenge and our psyches have developed many tricks to convince us that we are doing our best and that if we fail the problem was insuperable or the opposition unfair. In this paper I would like to explore three ways in which we dodge issues. The first is by not paying close enough regard to the language we use. The second is by not testing the threats we perceive, preferring to believe in our projection of the opposition rather than its reality. The third is by failing to come to terms with the political role into which our work inevitably casts us, and by sometimes talking as though we could escape a commitment to educational values. A discussion of the words 'effectiveness' and 'efficiency' leads to a suggestion that the proponents of two value systems implicit in these papers never get to grips.

A number of contributors to this volume draw our attention to a distinction to be made between 'effectiveness' and 'efficiency'. It seems there is some agreement, roughly speaking, that the 'effectiveness of teaching' refers to *how much* students learn as a result of it. 'Efficiency' involves the idea of cost: what is the price we pay in time and money for the effect our teaching has. 'Cost-effective' and 'efficiency' seem to be synonymous, provided cost measures more than money but less than emotional expenditure, for 'efficiency' recognises anxiety or distates only when it impairs performance whereas 'cost-effective' may admit the

price we pay in these more subjective ways.

When we talk about 'effectiveness' then, we are talking about the *process* of teaching; more exactly, we are talking about the effect of our interventions on the process of students' learning. Even more precisely, we are referring to those interventions which affect speed of learning. Perhaps we also need some notion like the completeness with which a student learns what he sets out to learn. Speed and completeness would seem in logic to be two components which govern how much is learned. We might deduce from this that *what* a student learns, in the sense of completeness, is one of the criteria of effectiveness. 'Completeness' here relates back to the students' intention to learn. What of the staff's intention to teach?

Does 'effectiveness' refer to *what* is taught as well as to how much is learned? At first we might answer 'No': content is determined by purpose. The choice of purpose, we might argue, is a political or ethical decision. We can teach undesirable things effectively and efficiently. Yet further reflection shows that effectiveness cannot entirely be divorced from what is taught. Take the case of an architectural student learning to relate the dimensions of a kitchen to the size and reach of the human body. We might argue whether teaching the student how to do the appropriate statistical calculations is more or less effective than teaching him to read the appropriate tables. A second example of a different kind is to be found in the pages of this book. Does the teaching of study skills increase our students' effectiveness as learners? It is argued elsewhere in these papers that it does. It follows that *what* is taught affects how much is learned. 'Effectiveness', then, depends upon content (what is taught) as well as method (how it is taught).

This examination of terms has hinged on the idea of students learning a quantifiable amount; the phrase *'how much* is learned' has been stressed. That is because the concept of 'effectiveness', and even more surely that of 'efficiency', have meaning only in relation to the amount students learn[1]. What does 'quantity' mean when applied to learning? In principle there is not much difficulty in comparing the amount two students have learned if they have been learning the same thing. So long as we assume that what one person learns is qualitatively the same as what another learns, we can compare the amounts. In these

circumstances we can compare the efficiency of teaching methods, or indeed any other educational procedure.

In fact we believe that no two people do learn *exactly* the same thing. We may also assume that the same student must learn *something* different from one teaching method as opposed to another. But we also assume, perhaps not unreasonably, that those differences have only a small effect on the learning we are trying to quantify. In these circumstances 'effectiveness' and 'efficiency' do have some meaning even if attempts to measure them must necessarily rest on contaminated data.

However, is that assumption upon which comparative studies of teaching efficiency are based, always reasonable? How often are we teaching things the nature of which does not depend upon the way it is taught? We can, for example, think of facts which are independent of teaching method. Perhaps anything which can be objectified, in the sense that it has an existence other than as some attribute of the learner, can be separated from the learning and thus the teaching process. They are, in the behaviourists' terms, learning objectives which are extrinsic to the teaching method. But with objectives that are intrinsic to the method, comparisons of 'efficiency' become difficult, because the method *is* the learning objective. The educational end is the educative process. Vary the method and *ipso facto* you change what is learned. Thus not all the skills of surgery may be learned from reading a book, watching a master, or carving a cadaver; although some of the problems to look out for can be. Despite the example, perhaps extrinsic learning objectives are more numerous on science courses than on arts courses. (I avoid a contrast between Science and the Arts themselves, where such intrinsic objectives as the art of critical discourse might be thought both paramount and common to them all.) Maybe that is why attempts at measuring efficiency seem more feasible to many science teachers than they do to many arts teachers. Such comparisons always emphasise those objectives which are common to the teaching methods being compared. In the Arts they are more obviously the trivial ones.

What are the implications of applying the idea of 'effectiveness' to a comparison of two regimes under which students learn noticeably different things? This is not a mere academic question for as part of our daily work as teachers and examiners we are

frequently called upon to judge the comparative worth of two different kinds of learning. Which of us has not agonised over the marking of two radically different, yet meritorious, examination scripts? We do not stop at judging the relative quantity which two students have learned, we temper our assessments with judgements of quality. Implicit in our work is a scale of values which allow us to judge the relative merits of a student who has assimilated all the facts and one who rather has learned to make judgements reflecting a defensible and consistently applied set of values. What the basis of this implicit conversion table is, how much agreement there is between us and how consistently we use it, are all mysteries. Yet we will be forced to use it for as long as we insist on ranking our students rather than describing their work. Similarly any attempt to compare the effectiveness of educational experiences which lead to students learning different things must also employ this mysterious, and now universal, conversion table. All categories of learning must relate to one set of values. Everything our students learn must be quantifiable in the same currency. At least it must be in principle. If, in fact, we have not the tools or the procedures for quantifying accurately what is to be measured, then the acceptance that in principle it can be allows us to estimate.

It is perhaps here that some of the contributors to this volume would part company. Let us, for convenience, call one group the methodologists, the others the humanists. The methodologists are never so naive as to claim that all learning can *in fact* be quantified on the same scale. But, to the humanists at least, they do seem to imply that, had we but the means, men of good will would be willing to seek the common conversion table which would allow us to examine the comparative effectiveness or efficiency of educational approaches from which students learn different things. Or at least we would be willing to pin-point our differing values, enter our own figures on to the conversion table, and then apply our personal table to the effectiveness/efficiency formula. The differences in outcome would reflect our differing opinions on the most fundamental questions of value in education, and thus in life generally. However, that is reserved for a separate debate. Meantime we must get on with the job.

The radical humanist might argue that agreeing the conversion table is the last thing he wants to do;

that it is one of those dilemmas the very impossibility of whose resolution gives it its beauty and moreover makes it a worthy subject of study in an education dubbed 'Higher'. It is the kind of dilemma to be exposed and savoured by the teacher and the students in communion. This radical humanist would likely further argue that becoming adept at (and enjoying) wrestling with the problems of assigning values to dissimilar entities is a central goal of Higher Education. Add the need for the student to learn to take personal responsibility for the values he assigns and perhaps we are coming mighty close to describing the unique qualities which in the mind of our radical humanist distinguish 'Higher' Education from the rest. Thus to him the students' consideration of their personal conversion tables (or something like them) and their willingness to take responsibility for the values they may from time to time apply to them becomes core curriculum. It is the very stuff of responsible independent study. A radical humanist, arguing in this way, is likely to shun the very idea of applying the concept of effectiveness to education for the need to fix the values on the conversion table is subversive to his very notion of Higher Education.

I have caricatured two types. It seems to me that there are representatives of both camps among the contributors to this volume. Yet on reading their texts they do not appear to destroy each others' cases. For instance, Tyrrell Burgess argues, for reasons more elegant than but not dissimilar to those above, that it is difficult to convince educators to take seriously the idea of efficiency in higher education. Yet this volume carries examples of serious minded and respected educators doing just that. Will Burgess's arguments turn them from their way? Meanwhile, Marcel Goldschmid enjoins us 'experts' to devote our energies to arriving at 'valued conclusions with respect to efficiency'. And, no doubt, some of us some day will come to believe we have. David Gray may persist in showing up any methodologist who fails to convey his awareness of the moral and political implications in improvements of efficiency.

Assuming that the categories of 'methodologists' and 'radical humanists' represent more than my own ambivalence to the improvement of education, we need to carefully consider just why it is that the barbs of each group have so little effect on the other. In search of a possible answer we might first ask: how do the educators represented in this volume apply concepts

of efficiency, even make game attempts to measure it, and avoid the conundrums explored above? One way is that they take as their criteria of efficiency not how much students learn, but instead some aspect of what teachers do. Eric Hewton talks of sharing experiences and resources; Paul Black describes co-operative efforts to produce teaching materials; Mr Harris details the use of computers for making test papers; Marcel Goldschmid talks of 'acquiring instructional skills'. Even the last is removed at least once from 'helping students to learn'. It is in these very specific procedures, which are not themselves the interventions that teachers make in their students' learning, that improved efficiency is sought. Comparisons of learning, where they are made, are confined to comparing like with like; that is, two experimental groups are set to learn and are tested on the same thing. Thus the radical humanist's concern about the undesirability of equating categorically different forms of learning are avoided. The experimenter indeed is almost bound to confine himself to such simple comparisons for if he mixes categories he is liable to be criticised by his peers for sloppy experimental design. He is doomed by methodology to wander the lower reaches of the radical humanist's conception of higher education. Not that the grander issues of education are ignored, they are simply removed for separate argument. For example the effectiveness of 'personalised systems of instruction' is demonstrated by experiment and reported carefully in the literature. But meet the authors of these same papers and they spend their time telling you not of their experiments but rather extolling such virtues of the system as the closer and more egalitarian relationship which staff and students build, as together they explore their subject of study. Such things it would seem are to them the important values in Higher Education, even though they may not feature in the methodologically acceptable published papers.

So when we look at the evidence the methodologists are not actually storming the ramparts which the humanists are defending. When we come to look at the improvements suggested in these papers most of them seem harmless enough. So much so that we might pause to wonder why. Perhaps it is because methodologists are humanists at heart with no intention of storming the sacred citadel of higher education, indeed would join the barricades in the inside if called. In that case the humanists are nervous

scaremongers failing to recognise their fellows for they misunderstand their intentions.

There is another possible explanation. That is that the methodologists are coming, the stormtroops of the technocrats and administrators, but they have not yet got to the sacred walls. If that is the case, what is taking them so long? Could it be that our education system is so grossly inefficient in such things as: allowing staff to work together on the production of teaching materials; in marking routine tests of memory; in telling its students what to learn and how to learn it; in preparing its teachers in the basic arts of teaching; in organising its institutions to support its teaching programmes, that the more subtle effects of one type of teaching approach compared to another fall into insignificance? Perhaps we can argue that those crude inefficiencies would detract from the most unsophisticated kind of training programme; that students would learn less of *anything*. Perhaps it is only when we have put these grosser defects to rights that we can usefully come to grips with those matters which truly concern teaching rather than educational administration; that is, those interventions by the teacher which crucially affect the quality of learning and Learning as surely as the others affect their quantity. Then we shall discover whether the methodologists become the seasoned campaigners who come in to defend the citadel, or whether they are blundering warriors who crush its delicate treasures without having even perceived them.

That we should have to wait so long is a very serious matter. It shows that my methodologists and humanists have failed to communicate their intentions to each other. If the methdologists and humanists do not seem real people perhaps I may substitute the concerned educationalist and the concerned teacher with the justification that it is often the concerned educationalist who sees in the humanist teacher a disregard for the facts of educational research, and conversely the concerned teacher who sees in the methodologically correct educationalist a disregard for the quality of human culture.

Perhaps the types I have caricatured each exists more in the percepts of the other than in their view of themselves. A failure of these two groups each to perceive the other as they perceive themselves is all part of their failure to communicate successfully. Perhaps these papers show it only slightly. It is

more evident in the frequently strained relations which wax and wane between tutors and participants on staff courses; the educators and the educationalists, the doers of teaching and teachers of teaching, sometimes trying to find, often despairing of finding, a common language; each suspecting that the other does not appreciate what is being said to him. That is precisely the kind of breakdown that critical discourse is designed to overcome. Did the original conference not promote such critical discourse? It would be too much to expect strangers, drawn from six different countreis to get to grips in two days with all the issues that they have raised. But these papers will serve a useful purpose if they go some way to prevent us from heading for a fundamental breakdown which could conceivably result from The Great Debate, that discussion of the fundamentals of education wished upon us by our Prime Minister.

In our continuing critical discourse we shall have to look out for the "High Flyer syndrome" so near the surface in so many of us. "High Flyers" in David Gray's terms are those people who are superbly skilled in some aspect of some field and who in unguarded moments act as though they know it all. They are not willing to talk with others on a basis of intellectual equality. When we act in that way in a system which not only extols the virtues of rational discourse but is dependent upon it, we become the anarchists of that system. Such behaviour is represented as much by the bureaucrat who roughrides the teacher as by the teacher who dismisses the arguments of the economist. It is found in university teachers who prematurely reject the overtures from tutors on teaching methods courses. It is met among educationalists who are impatient with teachers concerned to protect their students from the intrusion of educational technology. After all, where should we expect to find high flyers if not in the senior positions of universities? You may answer: in the senior ranks of government. The Great Debate is between educators, educationalists, students, technocrats, administrators, politicians. It can fairly be assumed that the Prime Minister, when he called for the Debate, had in the back of his mind the growing costs of education. None of us in education can any longer doubt that if we are to improve or even maintain standards, we must learn to give greater value for every pound we spend. So it is in more than one sense that committing ourselves to critical discourse and finding the means to achieve it, is central to the whole matter of efficiency and effectiveness in teaching.

The Debate Over Teaching Efficiency and Effectiveness: Challenges and Conflicts

W L Weinstein

'The party is over.' Mr Anthony Crosland, as Environment Minister, when seeking to arrest the rate of increased expenditure by local governments in 1975, used this now notorious phrase. With rueful appreciation its aptness to almost all public expenditure has been subsequently borne out. Like a dark and menacing cloud the phrase continues to hang over British education, not least the sectors most dependent on local authorities.

With dramatic suddenness teachers in British higher education, like their counterparts in many other parts of the world in recent years, have found after more than a decade of unprecedented expenditure and expansion that their party is over too. The irritation expressed by some teachers has made them seem like petulant and spoiled children whose party has been abruptly ended. What many of them in Britain said in reply to Lord Crowther Hunt's initiative in 1975 reflected real, if often unanalyzed, outrage over suggestions that universities should become more efficient and engage in some manpower planning for the sake of meeting 'national needs'.

Undoubtedly very serious concerns, partly obscured by the partisan language in which they are expressed, underlie the diverse adverse reactions to unfavourable developments. Yet for all the apparent inevitability and sense of nemesis one now, in short retrospect, finds in the reversal of fortune in higher education, teachers need not quietly accept their fate. It is the terms in which they may express their concerns and formulate their public policies that calls for closer analysis.

I have started with the general theme of external pressures, eg financial constraints, on higher

education, which issue in a concern by government and groups in the wider society with teaching efficiency and effectiveness, and probably with an emphasis on the former (costs and numbers) rather than the latter (typically involving qualitative judgements). I shall first explore this area and then turn very briefly to a second area: the internal pressures, which have their sources within the ranks of higher education and research themselves. These pressures operate towards a concern primarily with teaching or learning effectiveness, and secondarily with efficiency.

These two areas pose their own respective challenges to higher education teachers. The first poses the challenge of how to formulate a political response to external pressures; the second, how to respond on the pedagogical level to essentially pedagogical criticisms of existing practice and prescriptions for improvement.

Very frequently, and as reflected in the conference's discussions, some teachers (designated approximately as 'humanists' by Piper) in defending themselves against the subversive and corrupting interferences of managerial, technocratic and bureaucratic figures, including cost-conscious politicians, have too readily associated these external marauders who threaten the inner ideals of higher education with those, coming from within the academic community, who have a serious concern with teaching effectiveness. Among the defenders of the academic citadel there emerges close to the surface a particular scenario: an impending *trahison des clercs*, led by higher education's own administrators, supported by new specialists in educational economics and teaching methods, with their cost-benefit slide-rules, and acquiesced in by a somnolent rank and file of teachers. The sharp sensitivity engendered by the change of external circumstance has at present led to an almost equally sharp antagonism towards fellow-academics conducting research, experimentation and speculation into the improvement of teaching and learning or the more efficient use of resources. That is why it is important to distinguish the two areas for the purposes of analysis.

As in many other countries, the present winter of discontent in British universities can be understood by contrast with the preceding summer of content. Indeed, many higher education teachers today are themselves the products of the summery 60s, recruited when the expansionist future seemed indefinite and relatively unproblematic. In universities the staff

grew from 10,485 in 1956-57 to 28,871 in 1971-72. In the 1950s and early 60s the universities seemed to be invulnerable to external government pressures. They, it was thought, were the best judges of how to contribute to society and should have the freedom to decide how they would do it. Undoubtedly this was reinforced by the illusory but politically useful conviction that the more university and tertiary students there are, the faster will the economy grow. The loose connections, found in reality to fail any strict test of social utility, between graduates' qualifications, the jobs they fill, their success in these jobs, and the importance of the jobs to the economy, were not taken as serious points from which to question higher education's expansion.

Academics moved into a sellers' market, received bountiful aid for growth, and in general rode the crest of social demand increases for higher education and optimism about its social utility. Academics were also content to accept the benefits and opportunities conferred by this development, which (apart from the 'more means worse' debate) accorded neatly with their assumptions about the importance of education. Government spending, even as a proportion of GNP, went up on most sectors of education.

In the earlier days of expansion questions of social cost, manpower planning, productivity, plant utilization, and teaching efficiency were not urged upon higher education. Growth at times actually stimulated more concern with teaching methods, as new courses and combinations of old ones were developed, and as student numbers swelled and brought with them a changed clientele for the profession to cope with. Wherever teachers failed to attract sufficient customers to their own subject to justify government largesse, their minds turned to revision of the syllabus, ways of stimulating interest, improved teaching techniques, or marriage with more attractice disciplines. The interest in teaching effectiveness was stimulated further by the knowledge explosion, which meant that the skill-base for many subjects became increasingly specialized, and by the alienation of a significant minority of students.

In general teachers were immune from external pressures, apart from demands to increase student numbers, though even these were for a long time matched by increases of staff to preserve Britain's historically entrenched ratio of 1:10. The immunity existed partly because, instead of critical inquisition, there

existed and still operated with little obvious strain a trust in the educational elite on the part of government and public, and respect for the mystique of higher education. The existence was taken for granted of a publicly paid class, select, respected, largely unknown and unpublicized, who would get on with the job of expanding knowledge and transmitting it to the young, equipping them with rare skills of interpretation, analysis, observation and reflection. This residue of the value-system of higher education's small-scale days was carried into the ethos of mass higher education.

Probably the first mention of cost analysis emerged, not altogether fortuitously, at the same time that the social utility of higher education - as provider of scientists, engineers and technologists - was given emphasis. This can be found in the 1958 UGC report for the 1957-62 quinquennium. Through the late 1960s and into the 70s more concern developed with student numbers as a basis for financing institutions. More prescriptions and directives were laid upon universities and other higher education institutions; or at least they did not resist adopting the task of imposing prescriptions upon themselves. The basic assumptions of policy were not even questioned when the post-1972 White Paper slow-down in the rate of growth occurred. But the previous expansion itself had set resource problems of unprecedented magnitude, especially for recurring expenditure. In the late 1960s, Mr Crosland, then Education Minister, attempted to submit universities to government audit.

Within about fifteen years the great growth and outward success of higher education enmeshed it in a more directive system. The universities became more like agents of government acting in response to changes of opinion and demand, and changing exigencies of cost, and less like autonomous agents. Well over 90% of university revenue, most of it directly from the DES, was coming from government. Claims to resources were increasingly questioned, and for better or worse were adjudicated in terms of the output of student numbers. Lip-service was paid to quality; assumptions, like the 1:10 staff/student ratio, were enshrined about the maintenance of quality. But the politically relevant measure of output became graduate numbers; and this concession to the crudities of politics, made not only in Britain, seemed with growth continuing, quite harmless and in fact for many beneficial.

Nevertheless the context gradually changed. Higher education became increasingly dependent on political decisions, themselves in turn subject to a broader mass of public opinion, only a minority within which would have had what was still seen as the privilege of higher education. The universities' power declined, or their readiness to use what power they had declined. In time there emerged more aggressively government and public doubts about the social utility or the efficient use of resources in higher education. The reaction among teachers to the most recent spending squeezes is a feeling of being let down or cheated. It is an entirely predictable pressure-group type of reaction to disappointed expectations.

How might higher education teachers see themselves now as a pressure group? The following remarks are offered by way of general perspective.

It is quite possible that, although logically distinct, two claims have intensified in parallel: (1) the demand by sectors of the public and government that higher education should demonstrably be useful, eg in meeting 'national needs', and (2) the demand that higher education ought to be run 'efficiently'. Against the universities' insistence in Britain that more students not be taken unless the same type and scale of provision were made for them as for their predecessors, there developed ideas about shared use of facilities between institutions, extending the teaching year, enlarging lecture classes without significant extra cost, restricting variety when it produced many small and costly classes, and in general applying educational technologies to core disciplines. More than ever before higher education is seen as expensive to run, relative both to what it cost before in real terms, and to other socially desirable or useful enterprises. Certainly outside universities it is not considered outrageous to inquire whether economies could be made in teaching costs that would not materially affect quality. Under public pressures it has become more acceptable to state, 'Decisions about distribution of students should surely be made on grounds of cost effectiveness if the White Paper's emphasis on efficiency is to be realized' (THES, leader, 27.2.76).

Higher education academics naturally feel threatened by financial stringency. Their vocational orientation and their in-group criteria of assessment (most of which are either indefinite in application

or disputable in content or both) make them resentful of attempts to assess their performance as if it were like the output of an industrial system - whether this be in terms of an efficiency rated by reduction in average total cost per student (Wagner) or in terms of the output of 'useful' research (like the late Professor Linnett's list for Cambridge). Such anti-utilitarian sentiments were given trenchant expression by Ian Robinson (THES, 6.2.76): 'Education, like science, art and religion, has no further "objective". It is autotelic.' And: 'The people whose co-presence defines the university - the physicists, pure mathematicians, theologians, historians, classicists - may have much to do with culture, civilization, disinterested thought in "society at large", but they have no connection whatever with increasing the gross national product. None!'

However they do have at least one connection with GNP. They are salaried and supported out of it. Furthermore, it is not lost on educational sociologists such as A H Halsey that teachers in higher education, however much they may idealize their vocation, are part of an elaborate social mechanism which operates with marginal regard for the qualitative content of education, as experience or produce, and through which education is increasingly used as a channel for the filling of the occupational system. Educational institutions now play a critical part in developing socially necessary skills and in placing people in the division of labour. From this view it is but one short step to the view that education is part of the distribution of social and economic capital. Decisions are continuously being made on the amount of social investment in education of people of different ages, levels, economic strata, and occupations. Hence it is arguable that questions about social policy in education, conceived as a sorting mechanism of people, are merely stifled by the anti-utilitarian rhetoric of the idealized higher education culture. Perhaps it is nearer the truth to say that higher education exists in two worlds simultaneously: the sacred world of Robinson and the profane of Halsey.

Owing to changing conditions and perceptions, the profane is now the more insistent. Academics are now caught in an increasingly politicized context, in which education must compete strenuously against roads or hospitals or prisons. It is unpleasant to be reminded by the Training Services Agency that there

still exists gross inequality between public funds devoted to young people entering work and to those who continue in full-time education. Higher education must stake its claim to a relative priority among social goals. This is the harsh reality in which academics are enmeshed. In virtue of it higher education's output may be subject to 'measurement' in cost-benefit terms, or to 'increases in efficiency' that involve lower staff/student ratios; resentment increases because the guardians of the central values of higher education want no such tests. The cultural and human achievements to which they contribute are not subject to objective measurement. Yet such academics plainly still want the money. So society's input, the money, is measurable. What is not measurable, and is blasphemed if measurement is attempted, is the output for society. This is not an easy line to take politically and publicly when you are in competition with an ambulance service or a road-building lobby. Is it any wonder that the smooth-tongued lobbyists of higher education believe they are best defending it when grounding it in utility and efficiency while they are reviled by their own anti-utilitarian rank and file?

It is of course obvious that the insistence by government in Britain and elsewhere in recent years that economies should be made is a consequence of public expenditure problems; behind them stand political limits set by public tolerance of high taxation and high inflation. Notwithstanding the political rhetoric used, insistence on savings is not necessarily a stimulus to efficiency (whatever that may mean) in the use of resources such as capital, teaching labour or student raw material. Nor can the zeal for efficiency necessarily promote educational effectiveness understood as improving the quality (however defined) of whatever may be taken as central to the experience or product of higher education. But, as will be amplified later, these arguments - couched in terms of 'X not necessarily promoting Y' - do not exclude the possibility that X *could* promote Y. In higher education that would indeed begin to concede that the unthinkable is thinkable: that economies could promote efficiency, and that efficiency could promote educational effectiveness.

But nothing is now better calculated to raise academic hackles than the external pressure to stipulate learning objectives and to assess output against inputs such as labour-time, capital, skill

or dedication. To apply cost-benefit analysis seriously to education implies non-fanciful, non-arbitrary ways of quantifying, with money values attached, the very values which virtually all teachers assert to be incapable of such treatment. As one participant at the conference vehemently put it: to accept the Pentagon-like language of cost-effectiveness is the 'ultimate cop-out' for people in higher education.

Instead of inquiring further into the ideals-laden language of culture and knowledge for its own sake, resorted to by embattled academics, I shall get up on the fence and survey a wider perspective on the conflict in which they are now involved.

There may be a characteristic danger, that of myopia, in merely giving vent to hostility and uttering protective incantations in ideals-laden phrases when confronted with what can also be seen as a deeply complex set of political issues. It is true that higher education teachers will, while taking the money they are given and pressing for more of it on behalf of their institutions, have to impress upon the public, especially managers and politicians both inside and outside higher education institutions, the value of higher education independently of its cost effectiveness. Without this, together with an onslaught on the nonsenses of cost-benefit analysis, no political defence is viable. Indeed the value of higher education should still be asserted over and above the mastery of skills, as understood in, say, the Keller Plan discussed by Unsworth; that is, its quality is not comprehended merely by an amount of content-mastery, but principally in capacities for appreciative judgement, interpretation, independence and criticism.

But unless academics understand the pressures operating on 'the other side', and the reasoning that must perforce operate there, their chances of successful self-defence will be diminished. They would risk being seen by the wider public or government as mere special pleaders (though perhaps that status is far from exceptional in modern pressure-group politics), and as obscurantists about political realities. Whether academics like it or not, they must to some extent comprehend, and perhaps even in some ways accept, a managerial-bureaucratic perspective on higher education. This would involve seeing themselves as engaged not only in teaching or research,

but also in a fundamentally political process of disposing of scarce resources. Willy-nilly they are acting as managers of educational resources, as Conrad and Goldschmid remind them.

Yet this is to pose a real dilemma. The involvement in a managerial perspective on educational 'inputs' and 'outputs' carries risks of being corrupted, indeed, of insidious corruption from within. However the argument must be seriously considered whether it would be better if teachers were to take an active part in attempting to develop cost-effective ideas or efficiency criteria, as well as more serious methods of monitoring their own performances in qualitative terms. When under external attack professions often react self-protectively, with or without white-wash, by creating internal monitoring devices. But there is no guarantee that teachers would more effectively than otherwise control the intervention and implementation of these managerial approaches if they were actively involved themselves. There is the further risk that active involvement could lead to self-deception about the degree or quality of control which teachers exerted over the process. Balanced against this, however, is the view that the chance of influencing efficiency criteria and limiting their application to things where it makes sense to apply them is lessened by teachers' non-involvement or crude resistance. Moreover, more control for teachers can come through their involvement as active critics of the work done within their own ranks on teaching effectiveness and resource-use efficiency.

Of course if we academics do contribute to a process whereby our effectiveness and efficiency are to be 'measured' in various artificial and distorting ways, we only accelerate a process there are good reasons for resisting. Yet even the posture of pure resistance (acceptable when it rewards an unqualified good cause) conjures up today the image of a privileged group refusing to measure its own performance and preventing others from doing it. Does the guild have something to hide; is itsperformance unmeasurable; or is it in the public interest that its measurement be done privately? It sometimes seems that teachers, like some other groups which shall remain nameless here, wish to avoid being made accountable to society for what they do with its capital and people. Very often the extreme evasion of accountability is not seen as such; the rectitude of the profession is held to stand as a sufficient

guarantee. Academic or artistic freedom is not to be bargained against social utility. Such attitudes stand in the way of any reasonable dialogue between those who are deeply suspicious of teaching-effectiveness methods and hostile to cost-cutting efficiency concerns on the one hand, and those who have a desire to promote these causes on the other hand. When supping with the devil take a long spoon. Better still, don't sup with him at all.

An understanding by the academic of 'the other side' is not advocated here for the sake of social harmony or political accommodation. In any case, it is not true that political or social conflicts, in this instance conflicts internal to the teaching fraternity as well as between sectors of it and external forces, are harmful and regrettable. Nor need it be thought that such conflicts may be dissolved merely by means of mutual understanding of divergent perspectives. One could of course argue that there must eventually be mutual understanding, negotiation, pressure and counter-pressure, debate and dispute, and compromises (shabby or unshabby). But not to face the facts of political life seems to be neither congruent with the inner ideals of rationality valued by those engaged professionally in education nor to be to their advantage as an interest group.

It would be useful briefly to characterize how some other professionals with their own standards and goals have interests in imposing cost-effective or other efficiency criteria on higher education - partly because they are themselves under pressure to apply such criteria to their own activity. In fact it could be worth looking at their position even if the attempt to apply - by imposition or agreement - some efficiency criteria to higher education were open to doubt on logical grounds or were judged inappropriate for policy making.

Politicians and administrators have public responsibilities for the allocation of resources on which competing claims are made by groups and interests of diverse power and legitimacy. It is arguably of the essence of liberal-democratic politics that there should be disagreement over the value of such interests, relative to one another, and there should be attempts to assert influence and change the balance of power among competing interests. In a nutshell, a main role of politicians and administrators is to act as decision makers and planners. They take decisions on social priorities,

subject to much external influence. The priority problems are central to politics; balances have to be struck.

Under the pressures of conflicting demands and interests, and given the ways in which their roles are constituted, it is natural that politicians and administrators should ask first of all: what value has a given activity for society? If they believe that higher education has no particular political relevance that could affect their positions, or if they have no significant financial responsibility for it, then politicians and administrators could let academics, as a privileged in-group, settle educational issues among themselves.

But in most societies today it is natural for the value question to be raised by politicians and administrators. They can also add to that general question several other questions: can the value of higher education be achieved with fewer inputs; can slightly less value be traded for relatively large reductions in costs? Indeed would society really miss a few academic research projects, a few teachers and students, perhaps even a few of the existing higher education institutions?

Not to ask and try to answer these questions is the ultimate cop-out for politicians and administrators. Much of the underlying tension in the present situation is grasped through the contrast between this claim, on behalf of one group of professionals, and the claim, reported earlier, that the ultimate cop-out for academics is their acceptance of cost-effective criteria imposed by politicians and administrators.

Furthermore, we live in a society of fragmented publics. There is no homogenous public self-evidently sharing a single perspective or set of principles and interests. One important kind of fragmentation, apart from the still important one of socio-economic groups, is professionalism in the division of socially useful labour. This yields a wide variety of service groups: engineers, doctors, soldiers, architects, lawyers, civil servants, accountants, computer programmers, social workers, etc. Each have their own axes for grinding. Yet the activities of each, as they render services to individuals and the general public, are properly to be assessed in terms of the most general public interests. To reject this logic is to be on the way

to refusing the need for public accountability. Admittedly for some, such as teachers, public accountability creates a tension between managerial concerns that are allegedly intrinsic to the enterprises of teaching, learning and conducting inquiry.

A central problem of modern liberal-democracy is how to reconcile competing claims without sacrificing justice or the common good. How common goods such as a quality of culture or civilization, national defence or public health, are to be promoted out of the melee is unclear. Each group naturally invokes a common good to press its claim on the aggregate of resources. It is natural to fear and detest the giant government machine and tiresome politicking through which inputs are fed in and outputs emerge. The higher education system may be seen as menaced by well-intentioned political and bureaucratic efforts to rationalize a fundamentally non-rational way of distributing scarce resources; and the rationalization deploys social utility criteria and cost-effectiveness assessments. And it may be argued that such ways are not non-rational after all, or that they are, among all politically practicable ways, the least irrational.

But are the teachers of higher education really different from many other professional groups to whom efficiency criteria are also applied, or may potentially be applied, by society and government? Groups such as doctors, nurses and hospital workers have their social utility. An obvious measure of it, perhaps too urgently introduced because of scarce resources, is the reduction in the number of days spent in hospital by patients. Probation officers are thought to be doing a better job if the recidivism rate declines. Social welfare officers' performance may be measured by the extent to which a range of legally defined needs among their clientele is catered for; that of the police, by how far they may be thought to deter the commission of offences and by their catch-rate of offenders.

Of course less superficial remarks would unearth real difficulties in finding relevant similarities and contrasts. And measurement of performance would be absurd without reference to contextual factors; eg how far the crime rate declines is not due to one variable, viz the vigilance of the police.

But the simple point here is that so many professions

have what might loosely be called production functions; they have measurable inputs and outputs by which their efficiency may be assessed. Much depends on the definiteness of their goals. Perhaps it is the indefiniteness of higher educational objectives, or their controversial nature, or their multiplicity, or their variability in terms of subject, recipient and teacher, or even the possibility of placing a high value on the process rather than the product, which makes analogies with other service groups questionable. If that is the case, then it is part of the political challenge to teachers that they should persuade society and government that their goals are necessarily open-ended and uncertain.

However it is true that there are aspects of professional activities that have no measurable output, and where it would be a distortion to impose efficiency ratings on that basis. The effectiveness of judges may be assessed in terms of the fairness with which they preside. A question of efficiency arises when, say, the costs of processing cases are thought to be disproportionate with the ends of justice, or when justice itself is frustrated owing to overloads that produce delays in the meting out of justice. Now a value like justice can be valued for its own sake (as can the diverse development of the person associated with educational ideals). But it does not follow that the value is corrupted if one qualifies the pursuit of it by reference to how much it costs. It all depends on our sense, itself not certainly right, of due proportion between goals and costs. Again, no one judges the efficiency of Parliament by the number of bills or pages of bills (or laws passed) divided by the number of hours spent by MPs. Here complex qualitative judgements override quantitiative concerns; for the purpose of Parliament is to enact 'good' laws and to reject 'bad' bills. But this does not imply that assessment of an activity in terms of cost related to benefit is necessarily impossible or impermissible, although it does suggest that efficiency considerations are secondary to questions like 'Efficient for *what*?'

In the political arena, then, we must confront questions raised by 'the other side', for example, what priority is to be given to X over Y and Z? Can the benefits X produces be had with less call on the total resources of society?

There is probably here an ineradicable tension between the call to be given the resources adequately to perform a professional job (and as most of us in education see it, on an upward curve of resource provision) and what government and other groups demand. If not as teachers then as citizens our responsibility is to claim a legitimate share and to minimize social costs in relation to benefit. In this respect that responsibility is strictly speaking external to teaching, as Conrad observes. But it is vitally important in the political presentation of higher education to the wider society.

So far I have discussed some aspects in the political context from which spring pressures towards either teaching effectiveness or, more likely, cost efficiency in teaching. One knows when the pressure towards the latter is strong: when, for example, a new self-learning strategy is abandoned on grounds of cost in money or time.

But not all pressures arise from external sources or bring about the politicization of teaching issues. For every teacher there is the possibility of an honest confrontation with questions of teaching effectiveness. No doubt this legitimate concern, which springs from vocational commitment, yields dispute about goals, criteria of success, and content in education. Many academics may entertain a healthy suspicion for self-paced learning packages or any new educational technologies which narrow down subjects to 'basic skills' when they contain important areas of critical judgement and interpretative disagreement, or call for the exercise of imagination and other personal capacities. Nevertheless it becomes the crudest obscurantism to claim that, say, a lecturer cannot be assessed according to quite sensible criteria of effectiveness, or that teaching cannot be learnt or improved upon. There may be legitimate areas of argument about how far it has become a vice to 'reduce' knowledge to examinable knowledge; but whatever view one takes on this issue does not preclude the self-critical scruitiny of one's success as a teacher nor the attempt to define one's teaching goals less sloppily than one had done before.

Indeed it may be argued in favour of some recent teaching experiments that they have been forcing us to focus more clearly on teaching objectives, and on the effort to distinguish essentials from non-essentials within a subject; and to focus more fully on the needs and capacities of the student, helping

to make explicit for him what may have been implicit. All this reflects on the fact that we now inhabit an age in which much less can be taken for granted, and much more has to be defined afresh, for both teachers and students, about educational aims and methods.

In this area there are few threats directed at the central values of higher education by philistine numbe.-crunchers. Researchers into established teaching methods and experimenters with new techniques resemble domesticated pets within the academic household, rather than Trojan horses. To appeal to the self-critical capacities and dispositons of academics: to call for institutional self-knowledge through discussion in the way Goldschmid does: to debate the merits of various pedagogic experiments: to seek ways of increasing students' motivation or speed of absorption - all this is to appeal to a fundamentally rational concern with professional self-improvement. In fact so far little in this movement suggests the mindless triumph of technique, of mere means, over ends.

Of course there are important areas of controversy internal to the subject. For example, it is a source of unending philosophical and practical argument how far the concern with learning as the acquisition of 'knowledge' precludes or includes the development of the 'personality' of the learner. Important definitional disputes about both 'knowledge' and 'personality' are at stake. But the ideal commitment to self-critical rationality by the teacher obliges him to consider his teaching effectiveness, *given* the particular way he or his faculty group or his institution conceives the relation between these learning goals.

Rigorous attempts, sponsored by educational specialists within the ranks of higher education teachers, to improve the effectiveness of teaching need be no threat to academic freedom or its associated cultural values, provided the spirit is experimental, the experiments are open to full criticism, and there is open debate about the aims and methods of education.

The concern of teaching-methods specialists with *effectiveness* (however debatably construed) need not support any concern with cost effectiveness. The conference papers seem not to have yielded one scheme for the improvement of learning or teaching which also involves a significant cost reduction. In fact

some schemes are found to be more expensive than their established alternatives; and at some points corner-cutting on costs, though possible, was resisted on educational grounds. The main interest in new schemes, naturally appealing because of their articulation of aims and criteria of success - a self-consciousness alien to the practice if not the ideals of the majority of teachers - is in their potential educational effectiveness. One might well disagree with some of the particular criteria of success that are chosen by experimenters, but this is hardly ground for supposing the immanent or the imminent corruption of higher academic values.

It is worth asking, if only from the political perspective developed before, whether there are any schemes likely to emerge from the authors of the papers or their associates which are *both* more cost effective and educationally effective compared with present main-line practices. Is it even possible that the pragmatic concern with economies can stimulate intellectual investment in schemes that are also educationally beneficial? Yorke's paper on micro-teaching united these two interests. Given the practical pressures depicted earlier, it may be time to consider many other possibilities. Or do they not exist?

The fact that the conference produced almost nothing along these lines is perhaps not to be ascribed to a failure of pedagogical perceptional or political imagination, or intellectual inventiveness. It probably testifies to the fact that educational experts in higher education are authentically concerned with educational improvement irrespective or in spite of cost. After all, their most immediate clientele are other subject teachers in higher education. Finally, it may exemplify another aspect of their insularity: their situation is not in the external political environment but within the internal environment of higher education institutions. In those institutions, where they are often not accepted as equals by better established colleagues, they are confronted with an almost endless succession of examples in their colleagues of ingrained conservatism about teaching methods. What more can the pedagogical gadfly want than this much to bite on?